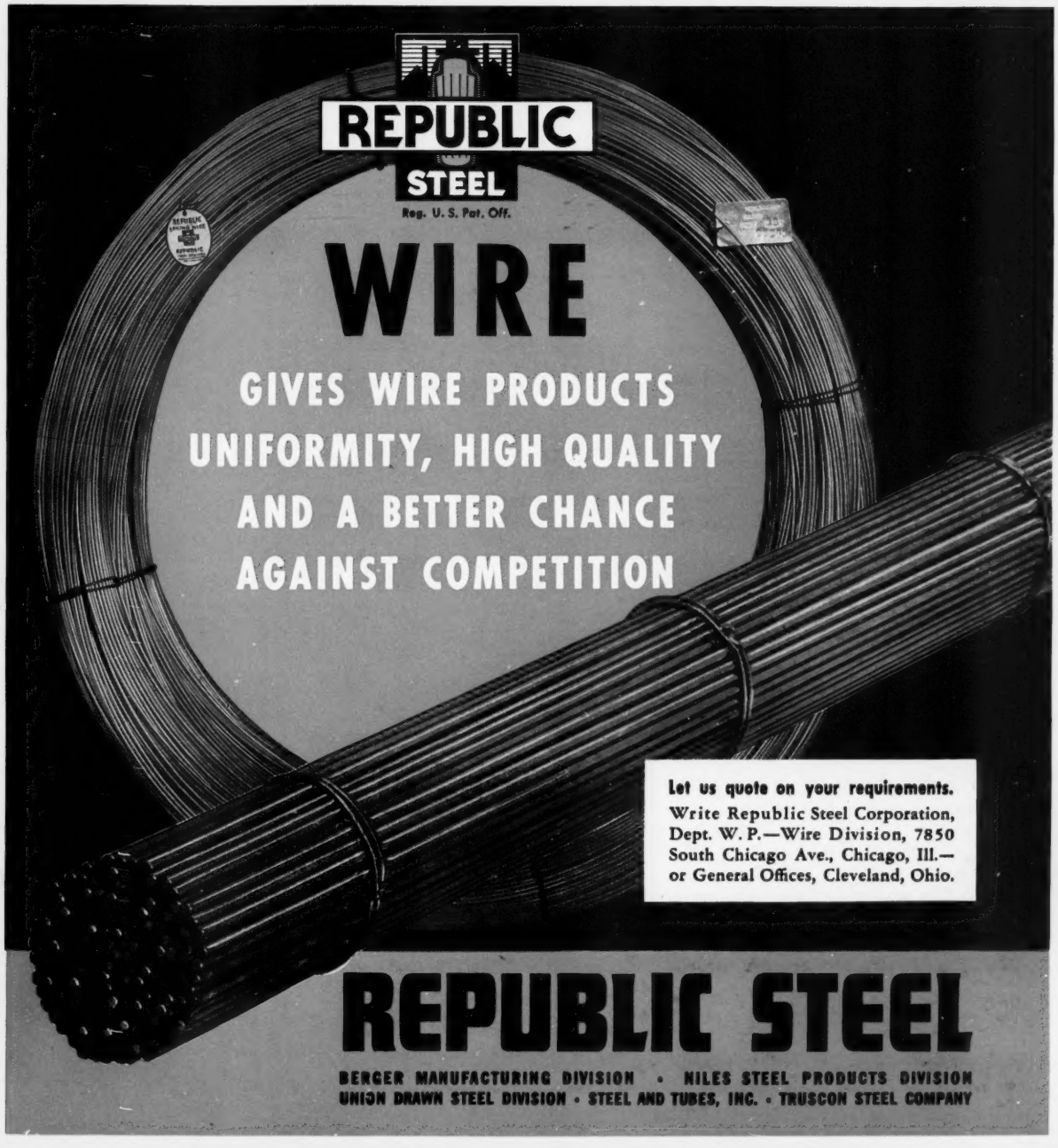
WIRE AND WIRE PRODUCTS

FEBRUARY 1938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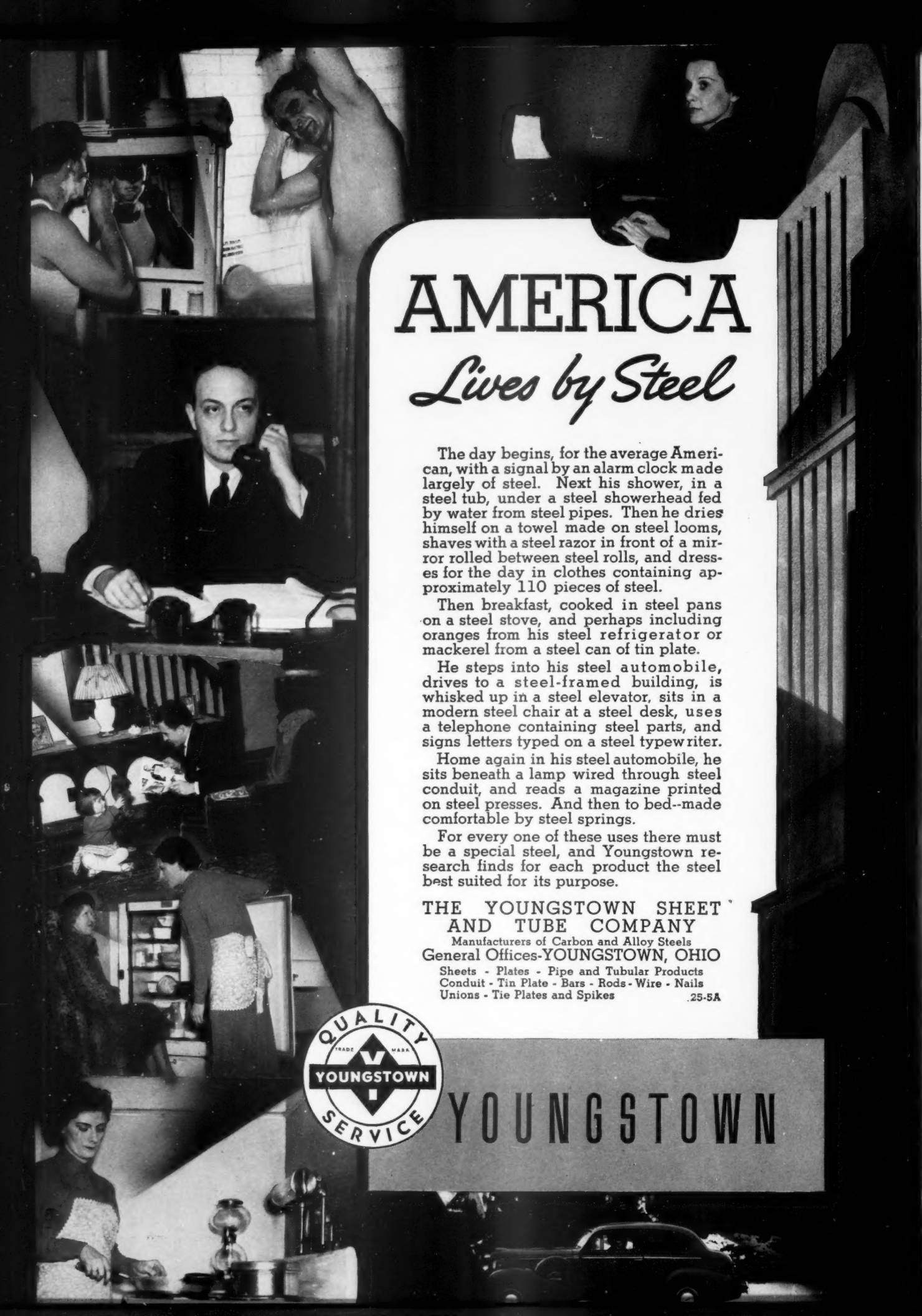

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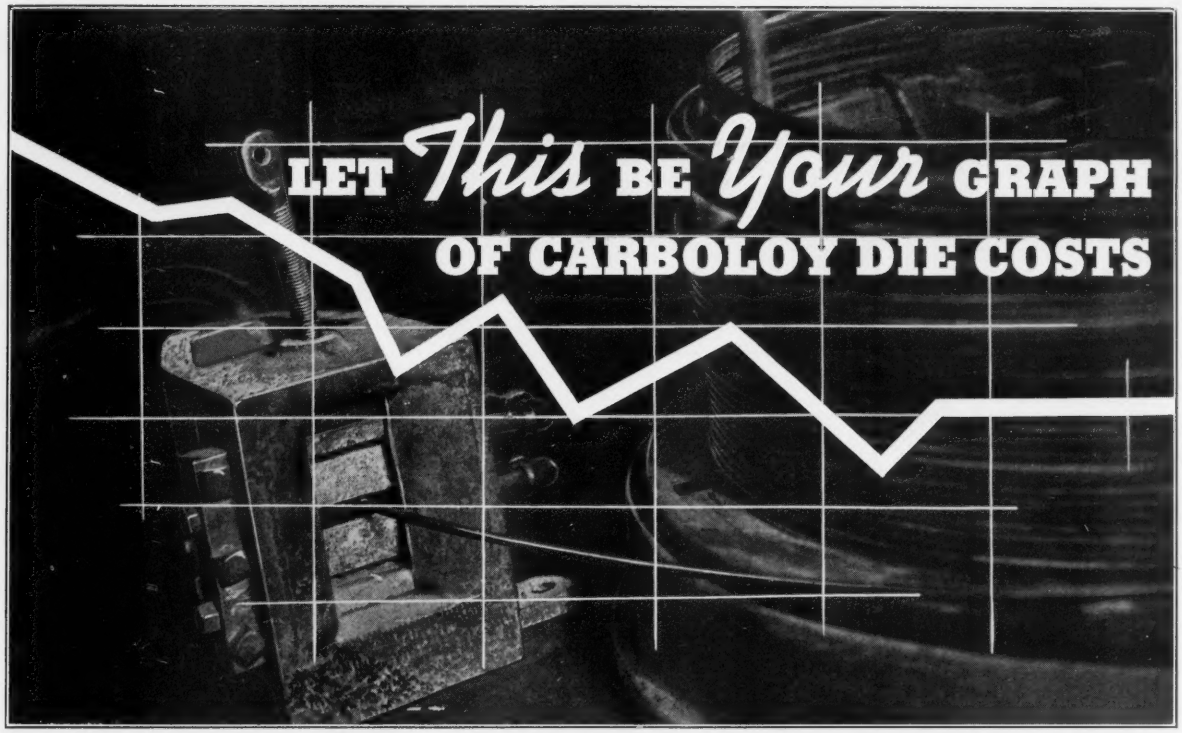

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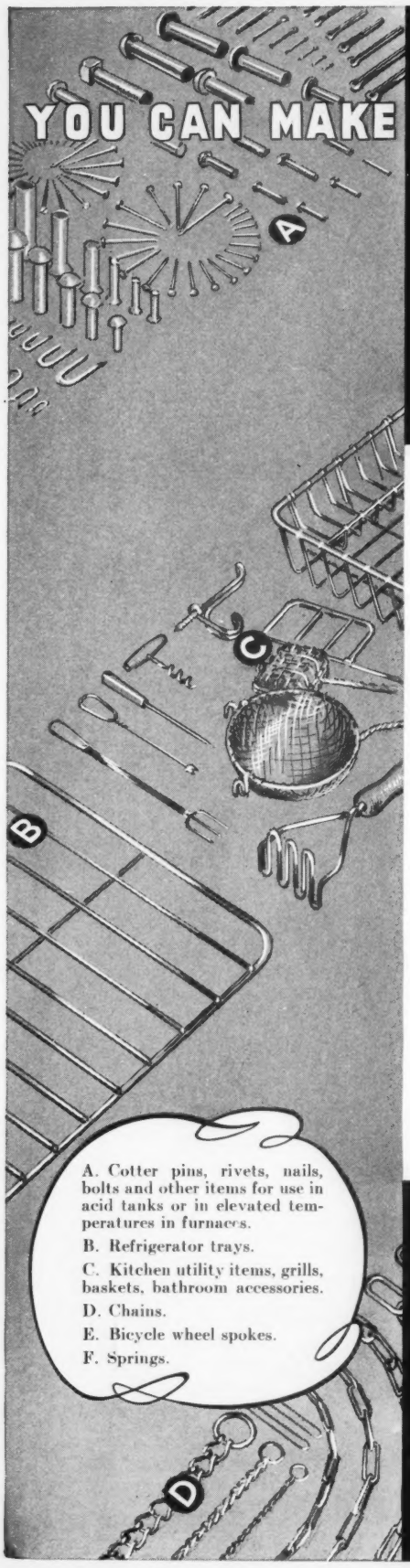

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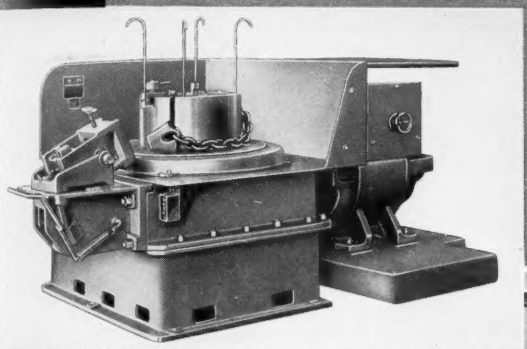

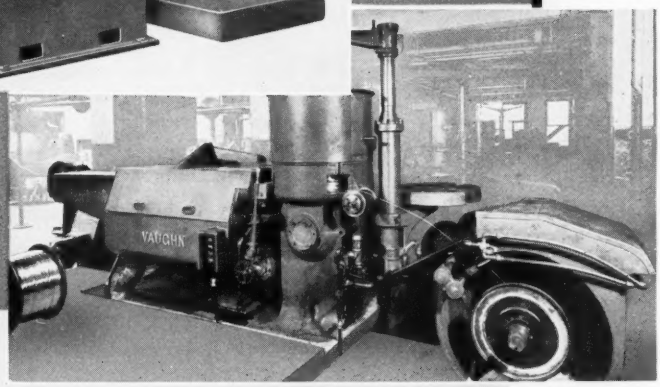

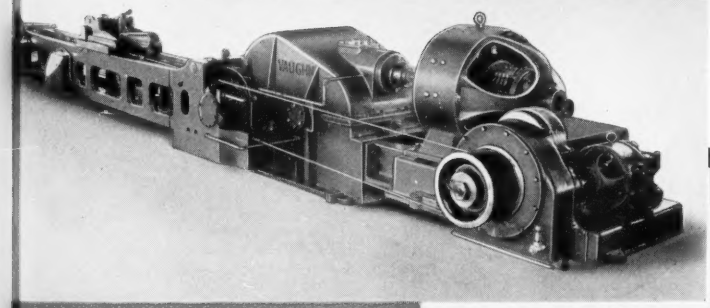

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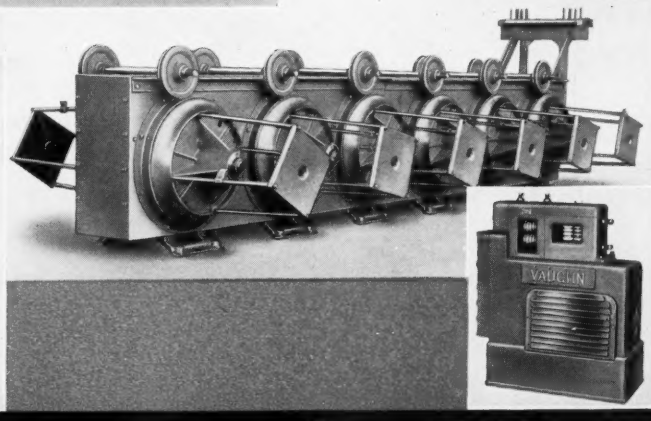

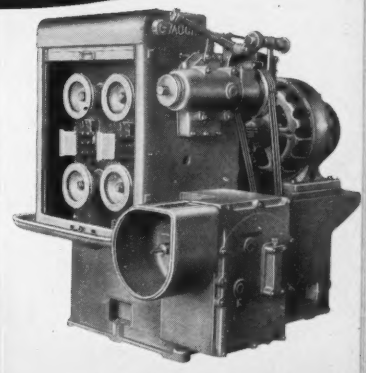

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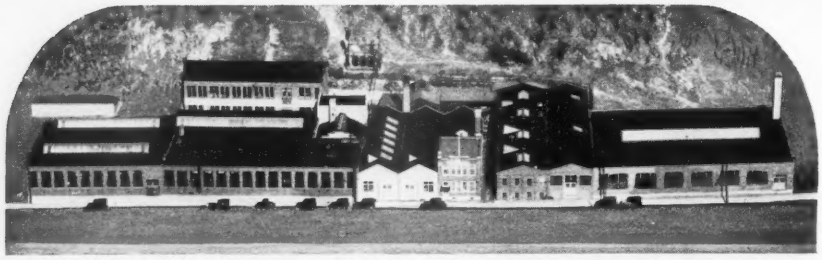

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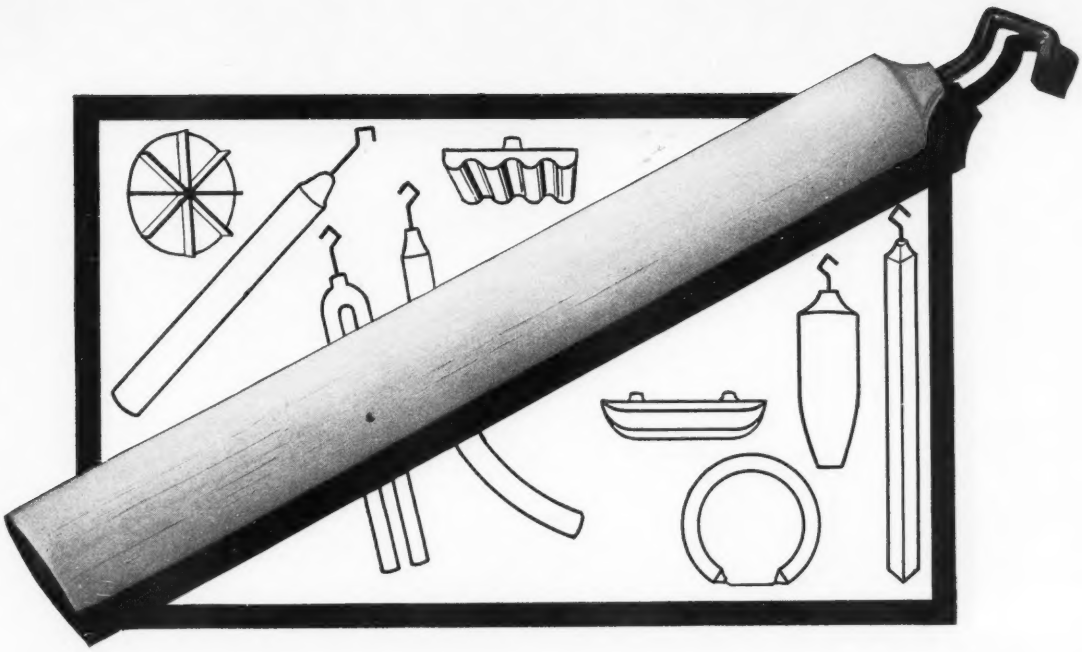

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A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 13 FEBRUARY, 1938 No. 2

Designated as

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1938
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of the
WIRE
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William Penn Hotel,
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FRIDAY, APRIL 1,
1938

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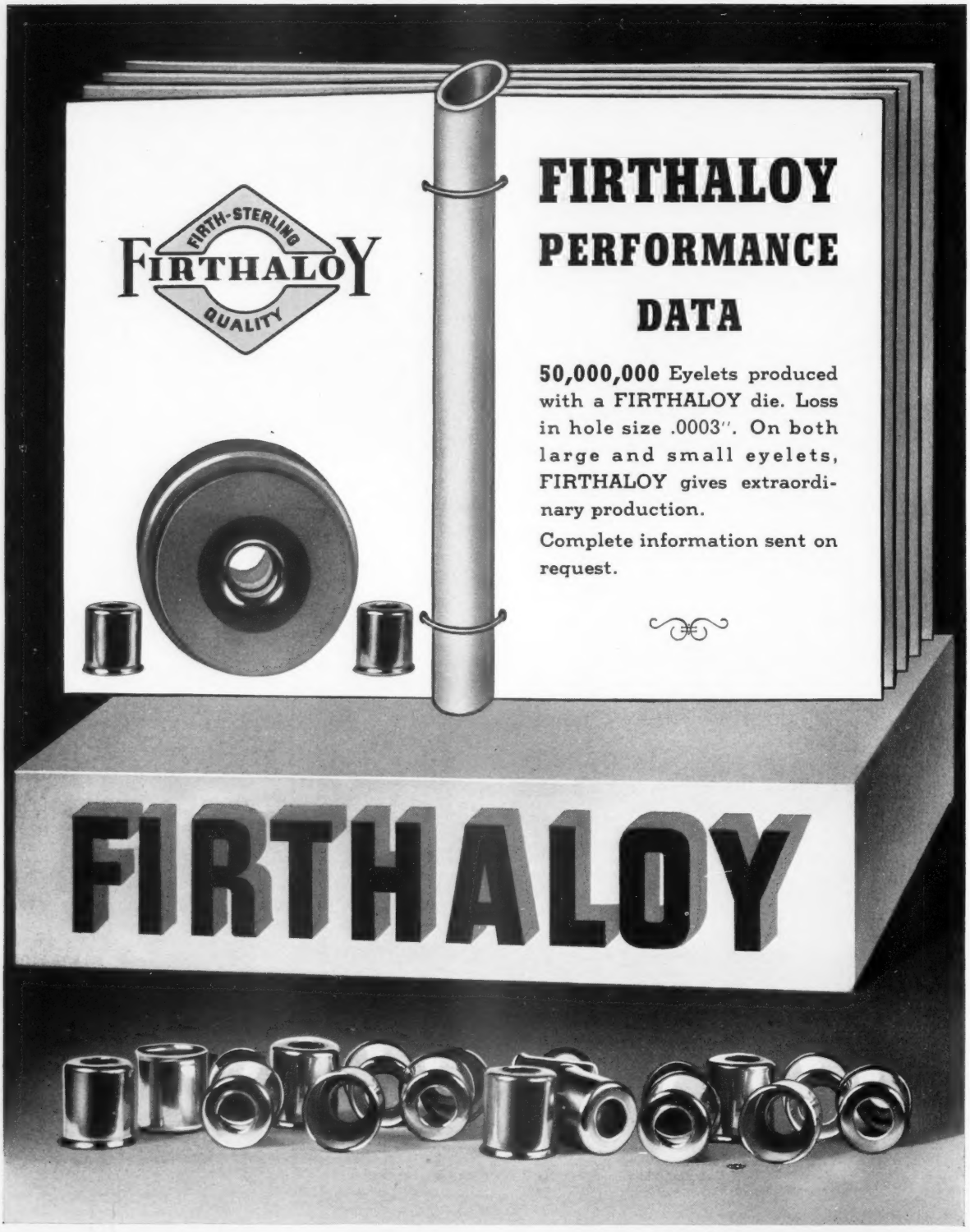

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING--- EXTRUDING --- FORMING --- FABRICATING

Vol. 13 FEBRUARY, 1938 No. 2

Rod And Wire Handling In The Industry

By A. F. Anjeskey,

Sales Manager, Cleveland Tramrail Division of
The Cleveland Crane and Engineering Company, Wickliffe, Ohio

A paper presented before the Annual Wire Association Meeting at Atlantic City, N. J., October 1937, outlining the advantages of mechanical material handling in rod and wire mills. ✦ ✦ ✦ ✦ ✦ ✦

THERE are still quite a number of rod and wire mills that have not modernized handling operations to obtain maximum handling economies to the same extent as has been possible by the use of modern rod rolling and wire drawing equipment, drawing dies, furnaces and so forth.

✦ ✦ ✦

WITH the keen competition in the sale of wire products many such plants cannot operate profitably, and therefore become marginal producers, that is, they can operate profitably only, when prices are high and deliveries of finished products from efficient plants are slowed up because of volume, thereby enabling the marginal plant to operate and possibly sell its product at a premium for quick delivery. Such marginal plants can become efficient producers by the installation of modern equipment without requiring a complete physical change of existing buildings.

✦ ✦ ✦

MODERN rod rolling or wire drawing equipment can be installed which can produce rod or wire in greater volume requiring less space, furnaces are equally efficient so that in most instances operations can be confined to a small area. The cost of handling and cleaning rod and wire can be reduced considerably, likewise, the storage and cleaning area can be decreased with the application of proper handling equipment.

A. F. ANJESKEY
Studied electrical engineering, taking night courses in Milwaukee, Wisconsin, and for a number of years was connected with the Allen-Bradley Company in Milwaukee in the Test, Engineering and Sales Departments. Since 1920 with the Cleveland Crane and Engineering Company as District Manager, New York Office. In 1923 transferred to the Tramrail Division, and since 1926, sales manager with headquarters at Wickliffe. Member The Wire Association.

✦ ✦ ✦

THE author's investigations of rod handling in rod mills and wire plants that purchase rod from other sources indicate that hand piling rod, flat on the ground with the coils nested permits piling safely about 4'6" high. It is not possible to hand pile above this height due to human limitations, even when storing 165 pound bundles. Aisles between piles are also necessary to enable the yard men to store, thereby decreasing the storage capacity per square foot of the storage area.

✦ ✦ ✦

BY this method about 200 pounds of rod can be stored per square foot of storage area. This figure is based on including in the calculations the necessary aisle space.

Designated as Official Publication by the Wire Association

It is practically impossible to obtain an average of the man minutes of time required to store a ton of rod by hand, as the conditions in the plants surveyed varied considerably. In some instances handling equipment is used, such as a single hook crane or hoist, and the rod is loaded on buggies, which are pulled by manual labor or power and the load must be rehandled, particularly at the storage point.

✦ ✦ ✦

ABOUT fourteen mills today are handling rod by the Cleveland Tramrail Hair Pin Hook method, consisting of two cab controlled hoist carriers, to which is suspended a hair pin type hook capable of picking up a 3300 pound load of rod or eleven 300 pound bundles. This hook can be tilted at either end, as hoists are individually controlled.

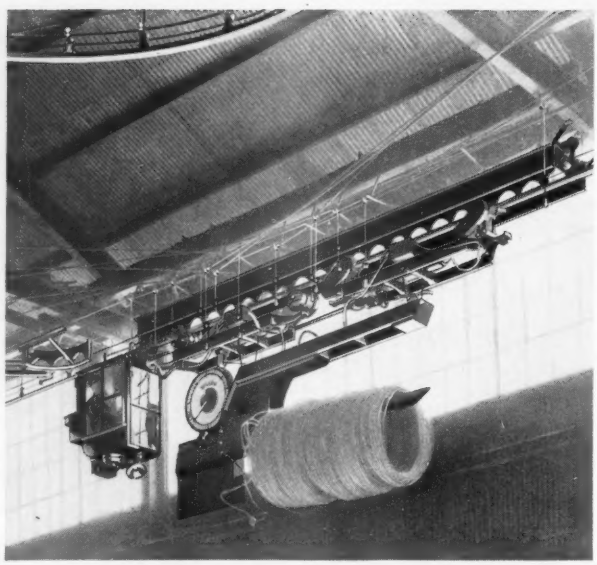

Figure 1.

✦ ✦ ✦

THE above plants roll about 35 per cent of the total output of rod in the United States. To this can be added an additional 10 per cent of the total rod output that is handled by this method in wire plants that purchase rod from outside sources, unload, store or deliver to the cleaning house with the hair pin hook system.

✦ ✦ ✦

HANDLING rod by this method completely eliminates aisle space and rehandling. The coils can be piled vertically, five high and sufficient clearance is provided in the storage structure to permit the hair pin hook carrier to pass over the pile with an additional pinful of coils. It is possible to store a minimum of 330 pounds per square foot of storage area with a possible maximum of 450 pounds per square foot, and this capacity is dependent on the number of sizes and alloys carried in storage. There is no difficulty in keeping the various sizes and alloys separated and it is possible for the operator in the hair pin hook carrier to store or select the proper grade of rod from the storage area without the assistance of a ground man. A plant making specialty wire may handle as high as eighty-seven various sizes and alloys and they can be stored in large or small quantities with row of coils of various grades adjacent to one another.

✦ ✦ ✦

BECAUSE of the use of this type of handling equipment it is possible to compute with reasonable exactness the time required to handle a ton of rod or wire from one place to another. The hoisting speed and travel of the carrier are a known quantity, and by observation of a well trained operator it has been found that with a 3300 pound load on the hair pin hook, which is picked up from the cooling conveyor or gondola car, raised in the air and transported a distance of 100 feet, lowered into position in storage, or at the cleaning house, the load deposited and the carrier returned to its starting position, the time required is 2.20 man minutes for the load or 1.52 man minutes per ton. For every additional hundred feet of travel in each direction, an addition of .31 man minutes time is required for the additional distance traveled. The operators become very skillful in manipulating the hair pin hook and have no difficulty in selecting a load from the storage pile despite the fact that the carrier is 30 feet above the ground.

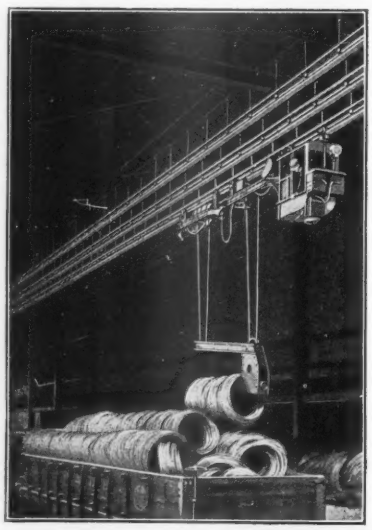

Figure 2.

✦ ✦ ✦

OF the installations made to date, the largest is capable of storing 10,000 tons of rod if same is carried in few grades or sizes and the smallest installation 1,000 tons.

✦ ✦ ✦

FIGURES No. 1 and 2 show views of the type of carrier used for the purpose. This carrier operates on an overhead Tramrail so spaced that the carrier is located over the center line of the row of coils in storage. The center spacings of the overhead Tramrail are determined by the size of coils to be stored, and it is possible to so locate the rails that 42″ OD and 48″ OD coils can be stored in the same area. The Tramrail or spurs over the rows of coils are connected to a main line of Tramrail by means of switches which are reeved with pull chains and handles

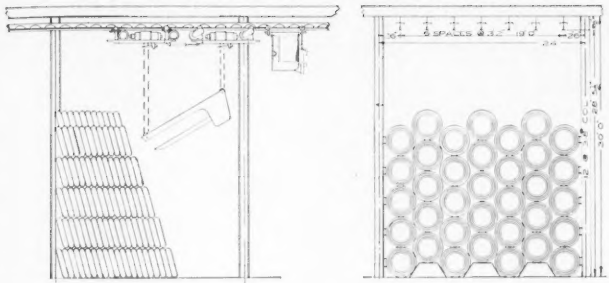

Figure 3.

located at a suitable height below the Tramrail so the operator in the cab of the hair pin hook carrier can throw the proper switch without assistance. The switches are provided with spring bumpers, which prevent the operator from passing the carrier accidentally through an open switch. Signal lights can also be supplied on the switches, enabling the operator to determine beforehand whether the switch is thrown in the proper position if he wishes to enter a particular spur line from the main track.

✦ ✦ ✦

FIGURE No. 3 shows an end and side elevation of a typical storage bay in the warehouse. The elevations have been determined to provide for piling coils five high, and also to provide railroad clearance over gondola cars when a plant ships or receives rod from other sources. Figures No. 4 to No. 8 show some of the layouts of installations made to date, and it is to be noted that in practically every layout an overhead track scale is also included, thereby enabling the operator to weigh incoming or outgoing loads and keep a record for the day's turn which can be checked against the records of the production department. The track scale can be obtained with a mechanism embodying a print-weigh attachment which prints a separate ticket with the proper weight and also records the same weight on a tape inside of the scale mechanism, thereby furnishing two duplicate records of the output. The relation of the scale mechanism to the hair pin hook carrier on the scale track section is shown in Figure No. 1.

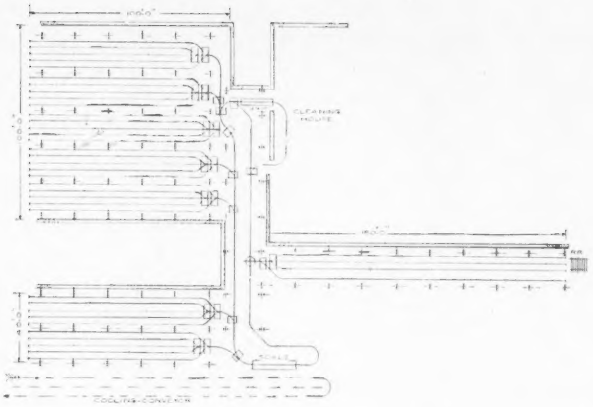

Figure 4.

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APPRECIABLE economies of operation are also possible in the cleaning house, both from the standpoint of handling rod or wire in the cleaning process and also from the saving of space required for a cleaning house, with a proper layout.

✦ ✦ ✦

IN a paper presented to the members of the Wire Association in October 1936, the author presented data which showed that the straight line type cleaning house had many advantages over the so-called circular type cleaning house. About twenty straight line type cleaning houses are operating in the industry today, and a comparison of the two types of cleaning houses shows that approximately one-half of the space required for a circular type is sufficient for operating a straight line type cleaning house which, incidentally, need not be over 18 feet wide. With a straight line cleaning house it is possible to use a single leg gantry crane for performing all the handling functions in the cleaning house. It is not necessary in this article to repeat any of the data presented in the author's paper on cleaning houses, as this is available in the 1936 Convention number of the WIRE AND WIRE PRODUCTS publication.

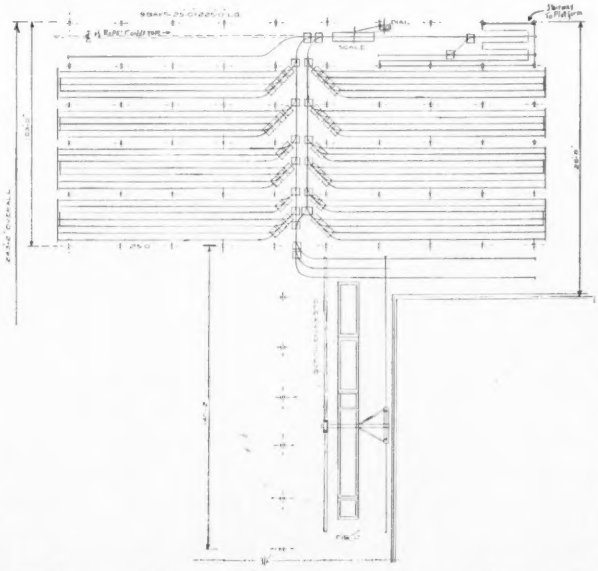

Figure 5.

✦ ✦ ✦

THE writer would like to emphasize, however, that additional surveys have shown that the wire industry can reduce cleaning costs by revamping present circular type cleaning lines. A recent survey in a plant operating a circular type line showed that by installing a straight line cleaning house with a gantry crane for handling, and also making provision for a flash baker in the line, the total area required was 2100 square feet or a space 18 x 120 ft. as compared with a former space of 100 x 140 ft. totaling 14,000 square ft.

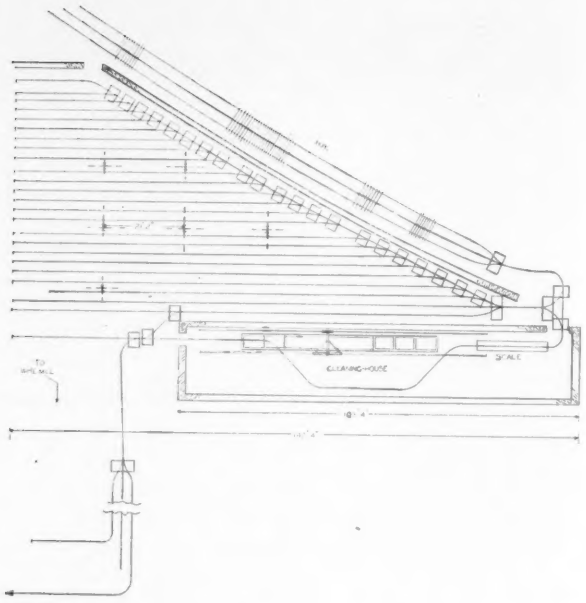

Figure 6.

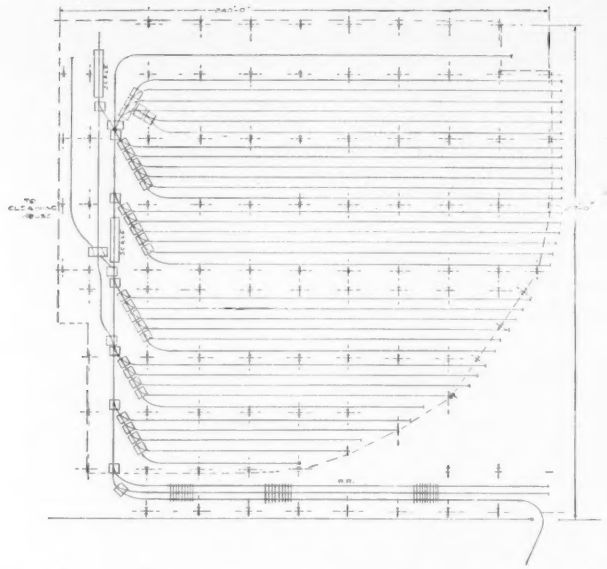

Figure 7.

IN other words, this plant gained 11,840 square feet for other operations, or sufficient space to accommodate five additional 12-block wire drawing frames.

✦ ✦ ✦

IT has been definitely determined that not over 2220 square feet of cleaning house area is required for cleaning a maximum of 420 tons of rod in a twenty-four hour day.

✦ ✦ ✦

WITH a straight line layout of tubs and a single leg gantry crane for handling, from data obtained in observing the operations of the installations made to date, it has also been determined that the labor cost in man minutes, to clean a ton of rod when same is handled through the cleaning line in 3300 pound loads is 11 man minutes in a plant where the cleaning cycle involves all the operations usually necessary to clean rod, such as placing the rod in the tanks, rinsing, sulling, liming and baking. In some plants, particularly bolt plants, where sulling or baking is not necessary, the total labor cost is 8 man minutes per ton of rod cleaned.

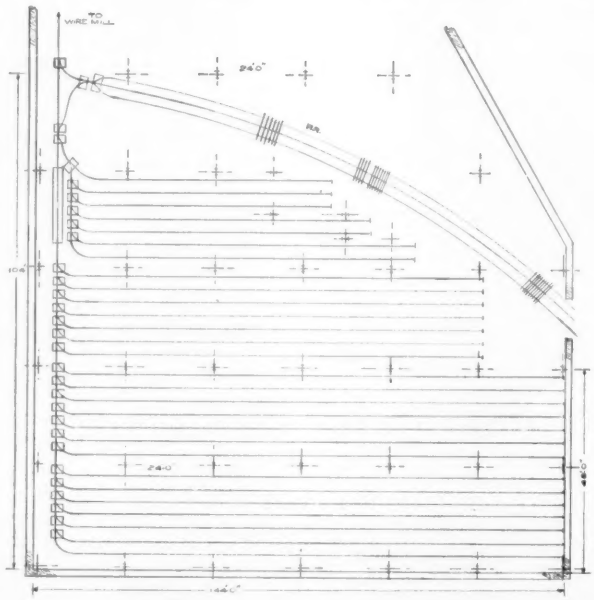

Figure 8.

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IN this article man minutes of labor time are mentioned because such time can be reduced to monetary cost by wire mill executives when making a comparison of the cost of operations in their own plants.

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How To Get The Greatest Benefits From The New Cemented Carbide Die Standards

By K. R. Beardslee

General Sales Manager,
Carboloy Company, Inc., Detroit, Mich.

A description of the simplification in carbide die sizes and prices which became effective November 15, 1937. In order to obtain greatest benefits from these new standards, it is essential that the buyer understand the complete plan which is presented herewith. ✦ ✦

PRIOR to 1932, in the wire, bar and tube industries there were in general use more than 100 various diameters and heights of cemented carbide die nibs covering a wide variety of hole sizes. Obviously, these heterogeneous requirements placed a severe handicap on die production and service, and in 1932 the first step toward simplification, through standardization, was made. At that time the number of nib sizes were reduced to 28 standards. Although this was a definite improvement, further simplification was desirable due to the large variety of hole sizes and nib shapes still required.

✦ ✦ ✦

AFTER extensive study by the cemented carbide suppliers in cooperation with users, further simplification was made effective November 15, 1937. This latest revision is considerably more extensive in scope than previous practice and provides unusual opportunities for economy to the user. However, in order to obtain the greatest benefits from these new standards, it is essential that the complete plan be thoroughly understood. Because of this it is felt that a general description of (1) what the new standards embody, (2) what the benefits are, and (3) the best method of obtaining the maximum benefits, will be of interest.

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INASMUCH as these benefits have been made possible by certain phases of the manufacturing technique employed, this description is preceded by a brief review of the cemented carbide manufacture.

✦ ✦ ✦

Cemented Carbide Manufacturing Method

CARBOLOY cemented carbide dies in the form known to the wire, bar, and tube industries are the combined result of many different processes from the mining of the raw materials through to the finished product. At this time we will only consider the processing of the pure powdered metal as it is made available for fabrication into die nibs.

✦ ✦ ✦

THE powdered constituents in general use are mono-carbides of tungsten, tantalum and titanium, or combinations of these, with cobalt or nickel the predominating cementing agents.

✦ ✦ ✦

INASMUCH as tungsten carbide with cobalt as a binder is the most commonly used Carboloy die material, we will consider this type only, although the processing of the other carbides is similar. Tungsten carbide is formed by adding carbon to the tungsten. This is inserted in a hydrogen electric furnace and heated to temperatures approximating 1500°C. as shown in Figure 1.

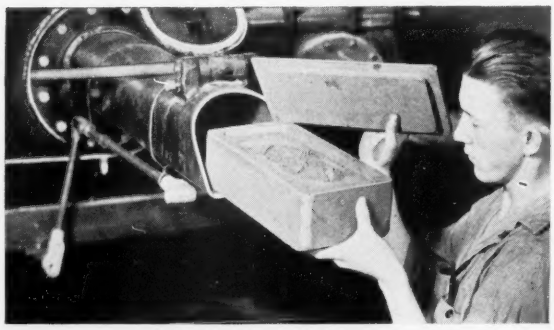

Fig. 1. A "boat" of tungsten and carbon being placed in furnace. This process produces the tungsten carbide. ✦ ✦

Fig. 2. The powdered carbides and cementing agent are thoroughly mixed by ball milling. View above shows a small batch of powders ready for the ball mill. ✦ ✦ ✦ ✦

COBALT is then added to the tungsten carbide and intimately mixed by a subsequent ball milling operation as shown in Figure 2.

✦ ✦ ✦

AFTER ball milling, the powders are then ready for the pressing operation, and it is at this stage of the process that the powders are given definite form. This is accomplished by either of two methods. By one method the powder is deposited in steel moulds so shaped that a suitable slab or ingot is produced. In this case an additional operation is necessary to produce the die nib shape or shapes required. This practice is followed at present in the case of special die nibs or where the quantity of identical nibs produced is not large. Under the other method special moulds are used that permit die nibs to be pressed to the desired shape (See Fig. 3). Through this method, both pressing and forming are accomplished with a saving of one operation. Die nibs produced by this method are termed "rough cored nibs". Obviously, when quantities are sufficient to justify shaped moulds, the production of "rough cored nibs" effects substantial savings both in labor and carbide.

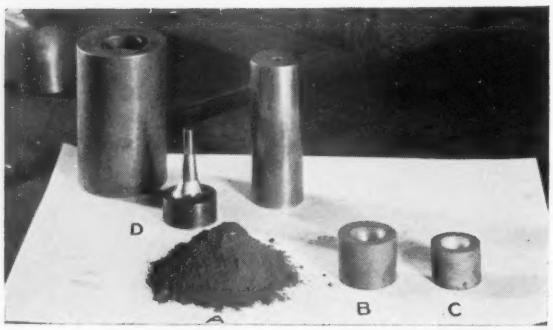

Fig. 3. After being ball milled the powdered metals are pressed. (D) shows a mould used to form the rough shape in a Carboloy die. (A) shows the powdered metal. (B) the die nib after pressing, and (C) the same size nib after being hardened. ✦ ✦

✦ ✦ ✦

FOLLOWING this pressing operation, the ingots are then pre-sintered at a temperature of about 850°C., in an electric furnace with a suitably controlled atmosphere. On removal from the pre-sintering furnace, the pieces pressed in the form of ingots (method No. 1) are formed into die nibs using standard tool equipment. Pre-sintered Carboloy is chalk-like and can be relatively easily machined if gently handled as shown in Figure 4. In this forming operation, as well as the pressing operation substantial dimensional allowance must be made for volume shrinkage that takes place in the final sintering. Final sintering is done under controlled time, atmosphere, and temperature conditions in an electric furnace and it is in this operation that the cemented carbide nibs obtain their final hardness. These nibs are then cased and are ready for subsequent finishing operations performed either by the cemented carbide supplier or the user, as the case may be.

✦ ✦ ✦

Rough Cored Nib Method Offers Greatest Economies

IT is apparent that the production of "rough cored nibs", namely, nibs that have been pressed directly to the shape desired, eliminating all forming operations and resultant waste of material, is unquestionably the more economical of the two methods described. The savings are appreciable. However, it is also obvious that unless the quantities of identical sizes are sufficient the use of special moulds for such production is uneconomical, and the possibility of passing such savings on to the user is eliminated.

Fig. 4. Boring a Carboloy die nib for sheet drawing. Nib is in soft state. Outside diameter of nib is about 2". ✦ ✦

✦ ✦ ✦

The New Standards Established November 15, 1937

THE cemented carbide industry realized that they could pass on to the user a substantial saving by the standardization of rough cored die shapes. Obviously no standardization could cover all requirements, but it was their aim to formulate a list which would benefit at least 75% of the users. Therefore, on November 15, 1937 the carbide industry offered to the trade 17 standard nib sizes (See Chart No. 1) with the same identical marking from all licensed suppliers. These nibs are identical in diameter and height, with standard casings provided.

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THIS standardization also covers 28 standard hole sizes .015" and up in rough cored nibs designated as R-1 to R-6 inclusive. These comprise over 90% of the dies used. See Figure 5.

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REQUIREMENTS in the larger sizes, R-7 and up, are so varied as to make standardization of hole size and shape impossible at this time. Therefore, these dies must still be furnished in a rough drilled and finished state.

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DUE to necessary allowance for shrinkage and inability at this time to ac-

curately control a small diameter plunger, cored nibs are not available under .015". However, to provide for these smaller sizes, 5 standard nibs (R-1 to R-5 inclusive) have been made available in the form of blanks with a standard shape cored three-quarters of the depth. See Figure 6.

✦ ✦ ✦

THESE blank nibs may be pierced, on suitable equipment that is already available in many plants, to hole sizes .004" and up. Nominal hole sizes of from .006" to .015" may be pierced at a minimum of 17 to 20 dies per 8 hour day.

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THE rough cored die, or the blank die that the die room has pierced, must then be put into the condition of a rough drilled die as shown in Figure 7.

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THIS operation is very simple inasmuch as in most cases only the back relief angle must be rough drilled to a meeting point and the approach angle cleaned up ready for finishing. Average production per 8 hour day per spindle for this operation is 25 dies.

✦ ✦ ✦

DIE NO.	MAXIMUM SOLID NIB VOLUME CU. IN.	STANDARD NIB		MAXIMUM HOLE SIZE		STANDARD CASING		STANDARD ROUGH CORED HOLES +.000" Tolerance: Holes under .040 −.003" +.000" Holes .040" &over − .005"				
		DIA.	HEIGHT	FERROUS	NON-FERROUS	DIAMETER	HEIGHT	Blank	.015	.025	.040	
R-1	.017	.325	.200	.086	.106	1"	1/2"	Blank	.015	.025	.040	
R-2	.025	.325	.300	.106	.128	1" or 1-1/4" or 1-1/2"	9/16" or 3/4"	Blank	.015	.025	.040	
R-3	.056	.450	.350	.156	.182	1" or 1-1/4" or 1-1/2"	9/16" or 3/4"	Blank	.015	.025	.040	.065
R-4	.079	.500	.400	.200	.230	1-1/2" or 1-3/4"	3/4"	Blank	.015	.025	.040	.065 .090
R-5	.176	.625	.575	.250	.280	1-1/2" or 1-3/4"	7/8"	Blank	.015	.025	.040	.065 .090 .120
R-6	.265	.710	.670	.300	.350	2"	1-1/8"	.015	.040	.065	.090	.120 .150 .200
R-7	.356	.768	.768	.375	.425	3"	1-3/8"	NO ROUGH CORED DIES IN THIS SIZE				
R-8	.509	.865	.865	.450	.516	3"	1-3/4"	NO ROUGH CORED DIES IN THIS SIZE				
R-9	.908	1.187	.820	.562	.687	3"	1-3/4"	NO ROUGH CORED DIES IN THIS SIZE				
R-10	1.573	1.500	.890	.750	.875	3"	1-3/4"	NO ROUGH CORED DIES IN THIS SIZE				
R-11	2.500	1.830	.950	1.000	1.250	4"	2"	NO ROUGH CORED DIES IN THIS SIZE				
R-12	3.750	2.185	1.000	1.125	1.500	4"	2"	NO ROUGH CORED DIES IN THIS SIZE				
R-13	5.147	2.560	1.000	1.250	1.750	6"	2"	NO ROUGH CORED DIES IN THIS SIZE				
R-14	6.434	2.560	1.250	1.500	2.000	6"	2-1/2"	NO ROUGH CORED DIES IN THIS SIZE				
R-15	8.836	3.000	1.250	1.750	2.250	7"	2-3/4"	NO ROUGH CORED DIES IN THIS SIZE				
R-16	12.623	3.500	1.312	2.000	2.500	7"	2-3/4"	NO ROUGH CORED DIES IN THIS SIZE				
R-17	18.850	4.000	1.500	2.250	2.750	9"	3"	NO ROUGH CORED DIES IN THIS SIZE				

Chart I. Specifications of the 17 standard sizes of one piece round hole cemented carbide dies recently established.

BY the use of charts as covered in the Carboloy Die Service Manual DS-711, it is possible for any wire mill to properly figure the correct rough cored die size to obtain for a definite finished hole size.

THE rough drilled die that the mill has made from a cored die, or that has been obtained in the drilled stage from the die supplier must then be put into the shape of a finished die.

THE finishing of dies with various approach angles and lengths of bearings is standard practice with all die rooms today. Therefore, it is unnecessary to cover this operation in detail.

THE entrance and bell angles are pre-formed, and due to the fact that they are wider than the approach angle or working part of the die, they do not have to be changed until the die has been recut several sizes. This means a direct saving in die finishing as well as a more easily controlled die shape.

✦ ✦ ✦

Benefits Provided By This Standardization

THIS simplification, or standardization, plan has enabled the cemented carbide suppliers to provide numerous benefits for the user. Among the most important of these are:

1. **Reduced number of original, or starting, nib sizes required.**
2. **Simplification of users stock and order problems.**
3. **Faster deliveries of dies at less cost.**
4. **An unusually large reduction in the price of rough cored (moulded) dies.**
5. **Substantial reduction in the price of rough drilled dies over .015″**
6. **Substantial reduction in the price of finished dies over .015″.**
7. **Further economies through a sliding scale of quantity prices on all one-piece round hole dies.**

✦ ✦ ✦

How The User Can Obtain Maximum Benefits

IN order to obtain the maximum benefits and economy from this new simplified plan, it is essential that the entire cemented carbide die requirements throughout the mill be carefully analysed. With this information available, an analysis should be made to adjust your specifications so that you can make use of standard cored hole dies. These dies are available in 28 hole sizes and five blank dies which may be pierced.

✦ ✦ ✦

OBVIOUSLY, for requirements in the size ranges covered by dies R-1 to R-6, the rough cored die classification provides the maximum savings. Most mills are equipped to rapidly finish rough cored dies at a substantial saving as compared to the cost of rough drilled dies previously used. Therefore, unless unusual circumstances prevent this, rough cored dies should be specified.

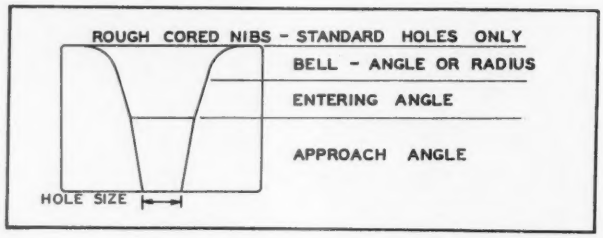

Fig. 5.

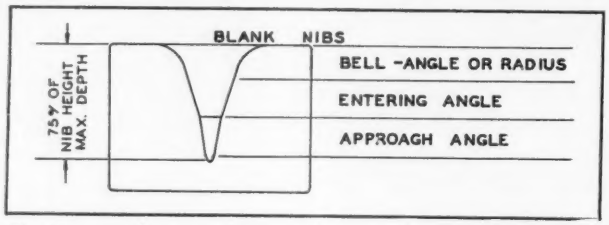

Fig. 6.

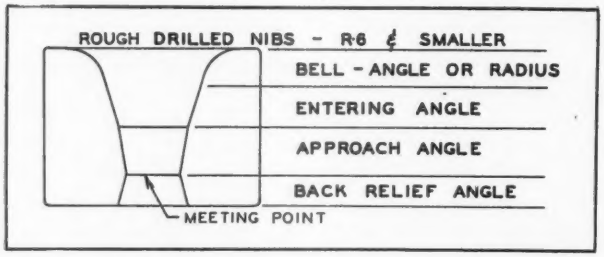

Fig. 7.

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CAREFUL analysis of complete mill requirements in most cases also enables the user to combine and group closely related size requirements into fewer original nib sizes. By doing this, the quantities of identical dies required are increased and the user can thus take full advantage of the sliding scale of quantity prices.

✦ ✦ ✦

USERS have found cemented carbide dies to be economical at previous prices. They also found them necessary to provide the closer tolerances, better finish, and improved physicals of their product required by the industry. With these reduced prices and further savings (aggregating 25% to 35%), users will certainly find increased use of cemented carbide dies more than ever justified.

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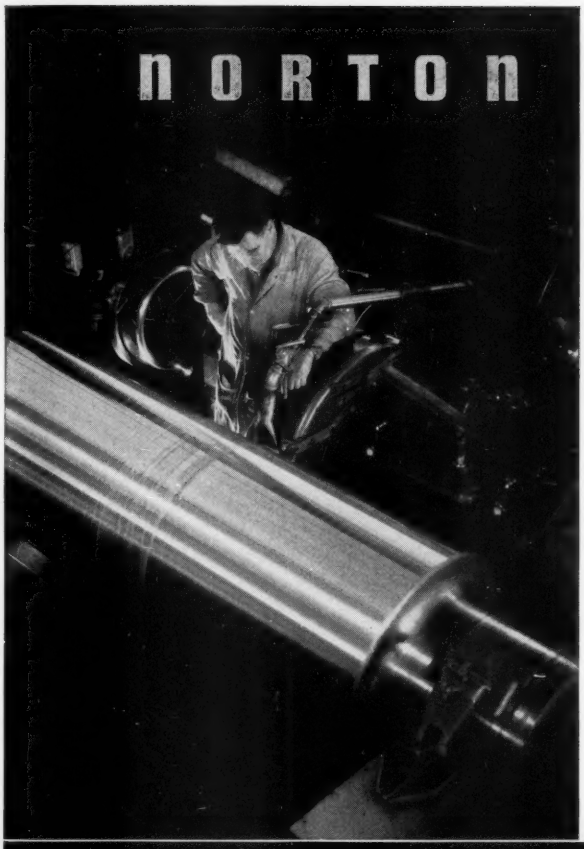

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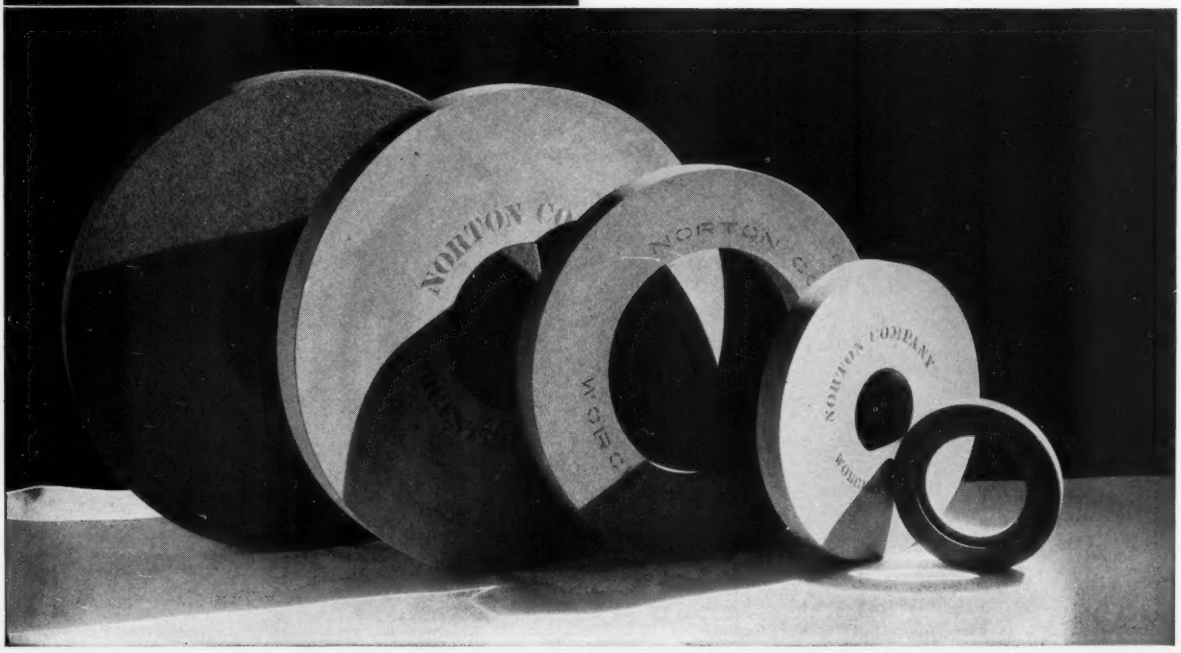

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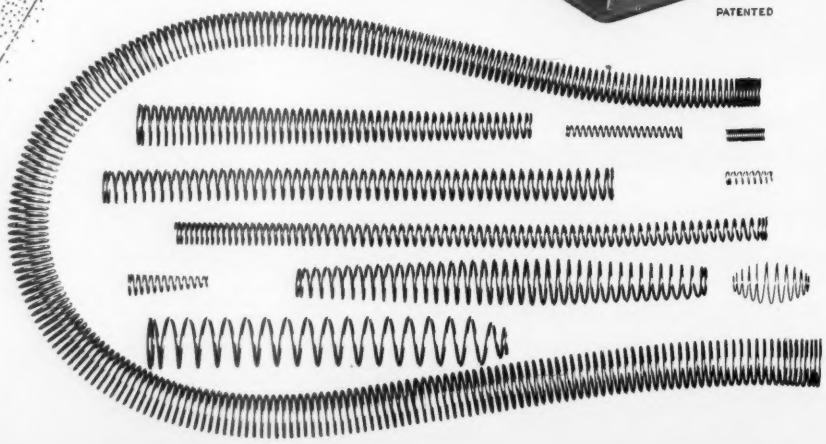

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Vol. 13 FEBRUARY, 1938 No. 2

Research On Fatigue Properties of Heavy Helical Springs

PART II

By C. T. Edgerton, Chairman,

A. S. M. E. Research Committee On Mechanical Springs

Progress report number three of the sub-committee on heavy helical springs of the Special Research Committee on Mechanical Springs of the American Society of Mechanical Engineers. ✦ ✦ ✦ ✦ ✦

Fatigue Tests on Series "C" Springs, of Plain Carbon Electric Steel

Section IV

THE material used for this series was electric melt tool steel made by the Halcomb Steel Company, heat number Chemical composition was:

Carbon	**1.05%**	**Silicon**	**.27%**
Manganese	**.21%**	**Chrome**	**.04%**
Phosphorus	**.008%**	**Nickel**	**.09%**
Sulphur	**.011%**		

✦ ✦ ✦

THREE-QUARTER inch round spring bars were rolled and sheared to 83½" long, tapered on both ends, and fabricated into springs in "as rolled" condition and surface finish. The springs were coiled hot, to graduated heights ranging from 12" for spring C-1 down to 8-19/64" for C-14. The corresponding range of pitch measurements was from 2.00" down to 1.28". Approximate mean helix diameter was 3¾", to give a spring index of 5, the same as for Series "A". Springs after coiling were cooled in air.

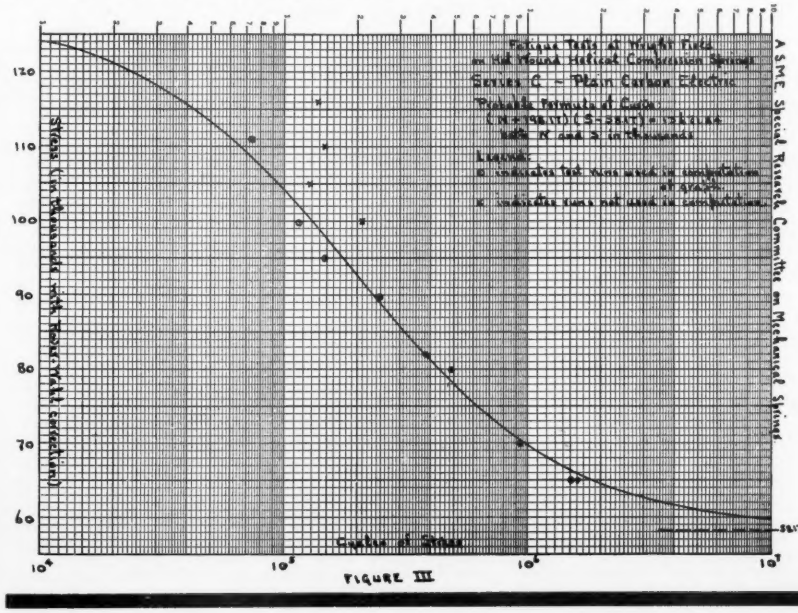

FIGURE III

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Heat Treatment

SPRINGS were reheated to a temperature of 1640° F. in a natural-gas fired furnace, and quenched in oil; then drawn for one hour (at temperature) in a lead bath at 700°F., and air cooled.

✦ ✦ ✦

Calibration Tests

THE springs were first compressed solid several times in a hydraulic spring tester, with the following results:

Spring No.	Coiled Height	Times Solid	Free Hgt. After Test
C-1	12"	5	8 5/8"
C-2	11 7/16"	5	8 3/4"
C-3	11 3/16"	5	8 35/64"
C-4	10 37/64"	5	8 33/64"
C-5	10 39/64"	7	8 37/64"
C-6	10 39/64"	6	8 13/32"
C-7	8 13/16"	7	8 9/64"
C-8	8 25/32"	6	8 1/64"
C-9	8 25/32"	6	8"
C-10	8 49/64"	6	8 1/16"
C-11	8 3/16"	6	7 3/4"
C-12	8 3/32"	6	7 25/32"
C-13	8 9/64"	6	7 3/4"
C-14	8 19/64"	6	7 49/64"

The ends of the springs were then ground square in a Gardner disc grinder.

✦ ✦ ✦

THE calibration tests were conducted in the same manner as

those on Series "A" and "B". Complete test data are given in Table VI. Measurements were taken on prick punch marks spanning four active coils, on springs C-1, C-5, C-10 and C-13.

✦ ✦ ✦

SPRINGS were then forwarded to Wright Field for the fatigue tests, together with six straight pieces, which had been heat treated along with the springs. These were intended for tension and torsion tests.

✦ ✦ ✦

AT Wright Field the test procedure was identical with that on Series "A". Tests with a magnaflux apparatus indicated no cracks. Measurements, loads and stresses, and results of the fatigue tests, are tabulated in Table VII. Results of tension and torsion tests were as follows:

In Tension	
Proportional Limit	**105000**
Yield Strength (.002"/in.)	**134500**
Ultimate Tens. Strength	**205190**
Elongation	**7%**
Ratio—Yield Pt./U. T. S.	**.66**
Modulus of Elasticity	**30600000**
In Torsion	
Proportional Limit	**60000**
Yield Point (.002"/in.)	**94500**
Modulus of Rupture	**164180**
Ratio—Yield Pt./Mod. of Rupt.	**.58**
Torsional Modulus	**12280000**

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THE tests at Wright Field are described in Air Corps Memorandum Report M-56-2783, a copy of which has been furnished to the Sub-Committee by Mr. Johnson.

✦ ✦ ✦

AN analysis of the results of the endurance tests was made, to determine the probable equation of the stress-endurance curve. Before considering this equation, it should be remarked that the procedure on this series was substandard in two respects. In point of time it was the first series tested, and we were to some extent "feeling our way".

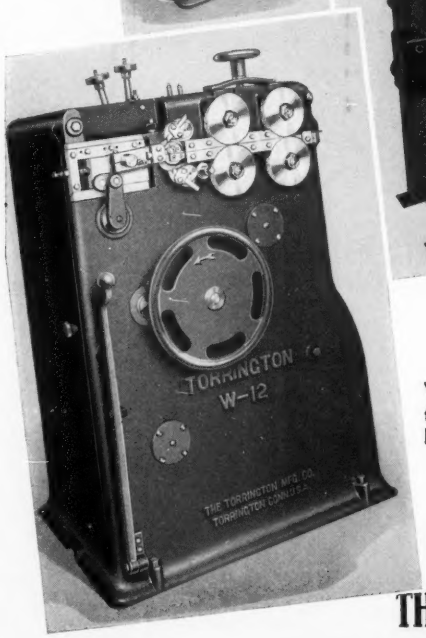
✦ ✦ ✦

IN the first place, the heat treatment was undoubtedly incorrect, as is clearly indicated by the abnormally low phys-obtained in

Springs Series C. TABLE VI Calibration Tests.

Loads in Pounds	Overall Heights Compression Front	Compression Back	Compression Average	Release Front	Release Back	Release Average	Loads in Pounds	Overall Heights Compression Front	Compression Back	Compression Average	Release Front	Release Back	Release Average
	Spring C-1							**Spring C-2**					
Free	8.421	8.438	8.430	8.371	8.377	8.374	Free	8.591	8.535	8.563	8.541	8.458	8.500
500	8.099	8.098	8.099	7.892	7.900	7.896	500	8.216	8.216	8.216	8.015	8.020	8.018
1000	7.720	7.715	7.718	7.451	7.451	7.451	1000	7.811	7.802	7.807	7.600	7.594	7.597
1500	7.354	7.347	7.351	7.054	7.041	7.048	1500	7.509	7.498	7.504	7.204	7.193	7.199
2000	6.967	6.953	6.960	6.663	6.650	6.657	2000	7.160	7.148	7.154	6.826	6.815	6.821
2500	6.614	6.600	6.607	6.282	6.269	6.276	2500	6.761	6.749	6.755	6.458	6.444	6.451
3000	6.158	6.145	6.152	5.917	5.903	5.910	3000	6.392	6.380	6.386	6.085	6.073	6.079
3500	5.743	5.730	5.737	5.606	5.591	5.600	3500	5.963	5.951	5.957	5.755	5.743	5.749
							4000	5.520	5.508	5.514	5.430	5.419	5.425
Solid	5.141	5.134	5.138				Solid	5.244	5.236	5.240			
	Spring C-3							**Spring C-4**					
Free	8.351	8.274	8.313	8.315	8.209	8.262	Free	8.362	8.313	8.308	8.235	8.293	8.264
500	7.956	7.951	7.954	7.755	7.758	7.757	500	7.938	7.951	7.945	7.761	7.777	7.769
1000	7.579	7.568	7.574	7.330	7.324	7.327	1000	7.580	7.582	7.581	7.349	7.352	7.351
1500	7.208	7.192	7.200	6.914	6.902	6.908	1500	7.200	7.195	7.198	6.912	6.907	6.910
2000	6.800	6.785	6.793	6.520	6.507	6.514	2000	6.810	6.805	6.808	6.550	6.545	6.548
2500	6.372	6.357	6.365	6.126	6.115	6.121	2500	6.425	6.420	6.421	6.215	6.209	6.212
3000	5.928	5.915	5.922	5.721	5.708	5.715	3000	5.981	5.976	5.979	5.789	5.783	5.786
3500	5.441	5.428	5.435	5.342	5.331	5.337	3500	5.528	5.522	5.525	5.449	5.438	5.444
Solid	5.124	5.115	5.120				Solid	5.218	5.211	5.215			
	Spring C-5							**Spring C-6**					
Free	8.423	8.443	8.433	8.386	8.391	8.389	Free	8.184	8.212	8.198	8.142	8.157	8.150
500	8.035	8.041	8.038	7.974	7.990	7.982	500	7.808	7.824	7.816	7.711	7.732	7.722
1000	7.726	7.726	7.726	7.560	7.565	7.563	1000	7.483	7.490	7.487	7.276	7.283	7.280
1500	7.378	7.731	7.375	7.151	7.150	7.152	1500	7.113	7.113	7.113	6.876	6.876	6.876
2000	7.008	7.004	7.006	6.757	6.755	6.756	2000	6.758	6.758	6.758	6.499		6.499
2500	6.607	6.602	6.605	6.377	6.374	6.376	2500	6.370		6.370	6.139		6.139
3000	6.233	6.230	6.232	6.028	6.026	6.027	3000	5.951		5.951	5.755		5.755
3500	5.829	5.826	5.828	5.664	5.662	5.663	3500	5.547	5.546	5.547	5.418	5.418	5.418
4000	5.406	5.402	5.404	5.338	5.335	5.337							
Solid	5.229	5.230	5.230				Solid	5.101	5.101	5.101			
	Spring C-7							**Spring C-8**					
Free	8.050	8.035	8.043	8.025	7.999	8.012	Free	7.803	7.765	7.784	7.761	7.741	7.751
500	7.698	7.712	7.705	7.607	7.625	7.616	500	7.459	7.421	7.440	7.390	7.354	7.372
1000	7.357	7.366	7.362	7.233	7.241	7.237	1000	7.113	7.063	7.088	7.004	6.954	6.979
1500	7.008	7.010	7.009	6.870	6.870	6.870	1500	6.779	6.722	6.751	6.653	6.595	6.624
2000	6.669	6.669	6.669	6.507		6.507	2000	6.442	6.385	6.414	6.311	6.254	6.283
2500	6.302	6.302	6.302	6.162	6.162	6.162	2500	6.093	6.037	6.065	5.951	5.893	5.922
3000	5.945	5.945	5.945	5.811		5.811	3000	5.735	5.678	5.707	5.643	5.595	5.619
3500	5.634	5.603	5.604	5.519		5.519	3500	5.380	5.323	5.352	5.329	5.270	5.300
Solid	5.269	5.262	5.261		5.519		Solid	5.215	5.155	5.185			

TORRINGTON *Spring Making Machines*



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Loads in Pounds	Overall Heights — Compression Front	Compression Back	Compression Average	Release Front	Release Back	Release Average	Loads in Pounds	Overall Heights — Compression Front	Compression Back	Compression Average	Release Front	Release Back	Release Average
	Spring C-9							Spring C-10					
Free	7.911	7.894	7.903	7.877	7.861	7.869	Free	7.925	7.975	7.950	7.903	7.931	7.917
500	7.595	7.562	7.579	7.515	7.488	7.502	500	7.626	7.603	7.613	7.530	7.504	7.517
1000	7.251	7.208	7.230	7.137	7.097	7.117	1000	7.282	7.246	7.264	7.168	7.134	7.151
1500	6.910	6.857	6.884	6.763	6.712	6.738	1500	6.956	6.914	6.935	6.822	6.780	6.801
2000	6.556	6.503	6.530	6.397	6.343	6.370	2000	6.605	6.560	6.583	6.452	6.408	6.430
2500	6.196	6.143	6.170	6.062	6.009	6.036	2500	6.252	6.207	6.230	6.114	6.070	6.092
3000	5.837	5.784	5.811	5.750	5.695	5.723	3000	5.882	5.837	5.860	5.768	5.723	5.746
3500	5.469	5.416	5.443	5.425	5.374	5.400	3500	5.506	5.463	5.485	5.460	5.416	5.438
Solid	5.337	5.287	5.312				Solid	5.320	5.279	5.300			
	Spring C-11							Spring C-12					
Free	7.537	7.436	7.487	7.501	7.411	7.456	Free	7.656	7.569	7.613	7.625	7.537	7.581
500	7.209	7.187	7.198	7.088	7.068	7.078	500	7.281	7.268	7.275	7.259	7.240	7.250
1000	6.859	6.826	6.843	6.736	6.705	6.721	1000	6.969	6.945	6.957	6.907	6.877	6.892
1500	6.489	6.448	6.469	6.386	6.343	6.365	1500	6.652	6.617	6.635	6.587	6.562	6.575
2000	6.194	6.150	6.172	5.997	5.952	5.975	2000	6.325	6.294	6.310	6.232	6.205	6.219
2500	5.866	5.822	5.844	5.732	5.685	5.709	2500	5.999	5.967	5.983	5.905	5.872	5.889
3000	5.531	5.488	5.510	5.417	5.372	5.395	3000	5.651	5.614	5.633	5.590	5.565	5.578
3500	5.200	5.157	5.179	5.155	5.113	5.134	3500	5.374	5.354	5.364	5.330	5.304	5.317
Solid	5.123	5.102	5.113				Solid	5.216	5.200	5.208			
	Spring C-13							Spring C-14					
Free	7.534	7.550	7.542	7.517	7.516	7.517	Free	7.684	7.665	7.675	7.652	7.634	7.643
500	7.219	7.207	7.213	7.155	7.140	7.148	500	7.338	7.318	7.328	7.303	7.287	7.295
1000	6.871	6.843	6.857	6.781	6.757	6.769	1000	7.059	7.024	7.042	6.960	6.927	6.944
1500	6.522	6.485	6.504	6.426	6.388	6.407	1500	6.710	6.666	6.688	6.602	6.565	6.584
2000	6.197	6.163	6.180	6.085	6.058	6.072	2000	6.391	6.336	6.364	6.260	6.221	6.241
2500	5.841	5.800	5.821	5.750	5.723	5.737	2500	6.027	5.987	6.007	5.942	5.903	5.923
3000	5.492	5.456	5.474	5.423	5.385	5.404	3000	5.710	5.674	5.692	5.637	5.596	5.617
3500	5.204	5.166	5.185	5.201	5.175	5.188	3500	5.401	5.360	5.381	5.368	5.326	5.347
Solid	5.185	5.152	5.169				Solid	5.319	5.287	5.303			

Deflection Readings on Four Active Coils.

Loads in Pounds	Spring C-1 Compression	Spring C-1 Release	Spring C-5 Compression	Spring C-5 Release	Spring C-10 Compression	Spring C-10 Release	Spring C-13 Compression	Spring C-13 Release
Free	5.39	5.35	5.32	5.28	5.05	5.03	4.82	4.81
500	5.17	5.02	5.06	5.01	4.85	4.76	4.61	4.57
1000	4.93	4.72	4.88	4.72	4.61	4.53	4.38	4.31
1500	4.71	4.46	4.65	4.45	4.40	4.30	4.13	4.07
2000	4.44	4.20	4.42	4.21	4.17	4.06	3.92	3.84
2500	4.23	3.95	4.16	3.95	3.93	3.84	3.67	3.60
3000	3.93	3.71	3.90	3.73	3.70	3.61	3.42	3.37
3500	3.66	3.50	3.64	3.50	3.43	3.40	3.20	3.21
Solid	3.10		3.18		3.26		3.17	

Spring Measurements, and Development of Constants.

Spring No.	C-1	C-2	C-3	C-4	C-5	C-6	C-7
Size of Bar (1)	.744″	.750″	.735″	.738″	.745″	.745″	.744″
Outside Diameter (2)	4.581″	4.594″	4.592″	4.550″	4.571″	4.574″	4.554″
Mean Helix Diameter (3)	3.778″	3.785″	3.802″	3.756″	3.769″	3.775″	3.758″
Spring Index (4)	5.078	5.047	5.173	5.089	5.059	5.067	5.051
Rover-Wahl Correction Factor	1.3050	1.3072	1.2986	1.3042	1.3064	1.3058	1.3069
M. F. S. per 1000-lb. Load — Conventional Formula	23362	22845	24381	23799	23211	23248	23239
M. F. S. per 1000-lb. Load — with Rover-Wahl Correction	30487	29863	31661	31039	30323	30357	30371
Capacity Solid—lbs. M. F. S. Solid — Conventional Formula	4220	4315	3820	3840	4200	4045	3980
Capacity Solid—lbs. M. F. S. Solid — with Rover-Wahl Correction	98590	98580	93135	91390	97490	94040	92490
	128660	128860	120945	119190	127360	122790	120880

Spring No.	C-8	C-9	C-10	C-11	C-12	C-13	C-14
Size of Bar (1)	.748″	.749″	.746″	.746″	.750″	.736″	.747″
Outside Diameter (2)	4.553″	4.552″	4.552″	4.550″	4.546″	4.518″	4.534″
Mean Helix Diameter (3)	3.757″	3.753″	3.754″	3.760″	3.750″	3.734″	3.740″
Spring Index (4)	5.026	5.011	5.036	5.040	5.000	5.076	5.007
Rover-Wahl Correction Factor	1.3087	1.3097	1.3079	1.3077	1.3105	1.3052	1.3100
M. F. S. per 1000-lb. Load — Conventional Formula	22904	22744	23074	23061	22634	23850	22650
M. F. S. per 1000-lb. Load — with Rover-Wahl Correction	29974	29788	30178	30157	29662	31129	29672
Capacity Solid—lbs. M. F. S. Solid — Conventional Formula	3730	3680	3740	3585	3650		
Capacity Solid—lbs. M. F. S. Solid — with Rover-Wahl Correction	85430	83700	86300	82670	82610		
	111800	109620	112870	108110	108270		

(1) Average of six measurements.
(2) Average of six measurements, not corrected for pitch angle.
(3) Corrected for pitch angle (perpendicular to helical axis).
(4) Ratio — Mean Helix Diameter / Size of Bar.

TABLE VII

Spring No.	Free Height	Solid Height	Total Deflection	Ratio Deflection / Solid Hgt.	Static Loading Compression No. Set in Inches 1.	2.	3.	Fatigue Loading No. of Cycles 6000	10000	Total Set	Load In Lbs. used in Fatigue Test	Stress Rover-Wahl Formula	Number of Cycles to Failure
C-1	8.30	5.20	3.10	.60	.08	.03	.02	.06	.00	.19	3630	111000	73600
C-2	8.38	5.25	3.13	.60	.07	.03	.06	.02	.00	.18	2750	82000	384400
C-3	8.24	5.10	3.14	.62	.07	.02	.02	.06	.00	.17	2840	89600	249300
C-4	8.18	5.25	2.93	.55	.04	.03	.03	—.05(1)	.00	.05	2260	70000	931200
C-5	8.35	5.25	3.10	.59	.05	.02	.01	.02	.00	.10	3300	99800	115300
C-6	8.10	5.10	3.00	.59	.04	.03	.01	.01	.00	.09	3140	95000	147200
C-7	8.00	5.25	2.75	.52	.02	.00	.02	.06	.00	.10	3830	116000	138000
C-8	7.72	5.20	2.52	.48	.02	.01	.01	.06	.00	.10	3700	110000	148200
C-9	7.83	5.30	2.53	.48	.03	.02	.00	.03	.02	.10	3385	100000	209800
C-10	7.89	5.30	2.59	.49	.02	.02	.01	.06	.03	.14	3496	105000	127400
C-11	7.45	5.10	2.35	.46	.06	.00	.00		.01	.09	2668	80000	486200
C-12	7.58	5.20	2.38	.46	.02	.01	.02		.00	.03	2208	65000	No failure 1507500

(1) Growth.

the tension and torsion tests. Secondly, owing to some misunderstanding, the test stresses assigned to the different springs had no close relation to the maximum stresses at solid height. The effect of this procedure on the fatigue test results is immediately apparent; for example:

Spring No.	M. F. S. Solid
C-1	128660
C-8	111800
C-5	127360
C-9	109620
Test Stress	**Cycles to Failure**
111000	73600
110000	148200
99800	115300
100000	209800

✦ ✦ ✦

CONSIDERING C-1 and C-8 as one comparative pair, and C-5 and C-9 as another the respective test stresses in each pair are almost identical, but there is a considerable difference in the solid stresses; in other words, one spring in each pair has been cold marked much more severely than the other, with the result that the life has been reduced about 50%.

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THE conclusion to be drawn from these results is of great practical importance to the spring engineer. The statement of the case, in spring designers' language, would be as follows:—In designing a helical spring for a service condition which involves a given maximum fibre stress, it is highly important from the standpoint of maximum endurance, to keep the solid stress figure as little above this maximum service stress as possible, allowing only the minimum "reserve movement" consistent with good practice.

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FURTHER examination of the test figures, as shown graphically in Figure III, indicates that the above conclusion applies more particularly to springs fatigue tested in the higher stress ranges; for the lower stresses, previous cold working seems to make little difference. Consider the following pair:

Spring No.	M. F. S. Solid
C-2	128860
C-11	108110
Test Stress	**Cycles to Failure**
82000	384400
80000	486200

✦ ✦ ✦

HERE the difference in endurance results may be pretty well accounted for by the difference in test stress. Therefore the much greater degree of cold work suffered by C-2, as compared with C-11, has not had much effect. In fact, it might be said that the test results on this series should be represented by a graph with two branches. On one branch are the C-1, C-5 and C-6 points; on the other C-7, C-8, C-10 and C-9; while C-2, C-11, C-4, and perhaps C-3, are on the "trunk" of the curve.

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IT would be interesting to carry the analysis further, and attempt to establish quantitatively the relation between the degree of cold work and the resultant reduction in endurance. But the data are insufficient. The problem is of enough importance to justify further experimental work, which will be included in the program as soon as practicable.

✦ ✦ ✦

MEANWHILE, the matter of immediate interest is to make a selection of such of the results from the Series tests as will make the probable graph logically comparable with that of Series A. This was finally accomplished by computing, for each of the Series A and Series C springs, the numerical ratio of fatigue test stress to M.F.S. solid. Series C springs were then selected, the ratios of which agreed fairly well with those selected of the Series A springs in corresponding stress ranges. The springs selected were C-1, C-5, C-6, C-3, C-2, C-11 and C-4. The

(*Please turn to Page 97*)

Roller-bearing parts are heat-treated in the furnaces controlled by these Micromax Pyrometers.

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Vol. 13 FEBRUARY, 1938 No. 2

Scale-Free Hardening Bolts---Continuously

By W. F. Ross,
Engineer,
The Electric Furnace Co., Salem, Ohio

The material is conveyed continuously through electric furnace in special protective atmosphere and discharged absolutely scale-free. + + + + +

THE numerous applications of the lowly bolt in this modern machine age are so common and varied that we are likely to minimize the importance of the bolt itself. However, a study of the important functions filled by this apparently insignificant little fastening device shows that much experimental labor and study has been spent in producing a commercial necessity which will be not only extremely inexpensive, but also endowed with a maximum of physical strength, combined with an irreproachable finished appearance.

+ + +

THE old fashioned carriage bolt, which was in its time quite indispensable, would be practically useless in today's high speed and high vibrational mechanical application. The highly developed bolt of today is not only exemplary in its fine machining, but sold with the guarantee of physical characteristics of strength and durability that the up-to-date bolt purchaser demands and receives.

+ + +

DEVELOPMENT of steels and steel alloys has done much toward providing bolts and unlimited life and endurance. However, the methods employed in heat treating bolts to produce a perfect finished product have been lead toward perfection in great steps during the last few years. Perhaps the greatest step forward has been the trend toward electrical heat for bolt treating.

+ + +

TYPICAL bolt hardening equipment of the most modern type is a key factor in the production of numerous sizes and kinds of bolts in the plant of the National Screw and Mfg. Company at Cleveland, Ohio, whose products are known throughout the industry for the notable uniformity of physical characteristics and for the pleasing finished appearance.

+ + +

ELECTRIC furnace equipment recently installed in this company's plant is of the continuous, chain belt conveyor type, designed for the scale-free hardening of bolts at a temperature of 1600°F. The furnace chamber consists of a fabricated steel shell lined with insulating material and refractories to form a tunnel, through which the continuous conveyor passes. Upon the hearth or floor of this chamber is placed a series of nickel-chromium alloy bars, which elevate the lower flight of the endless chain conveyor above the refractory hearth.

+ + +

THE hearth proper, formed by the upper flight of the chain belt, is supported on a series of grid type alloy plates supported on beams mounted under the upper flight of the conveyor.

+ + +

SUSPENDED from the roof of the heating chamber and at a level just under the upper flight of the conveyor belt, are placed heating elements, which consist of heavy cast nickel-chromium alloy grids, so designed as to present a maximum of radiation area to the interior of the furnace chamber. These grids form two furnace sections or zones, each of which is arranged to take energy from 3 phase transformers connected in Scott. Each zone is automatically controlled by means of pyrometers, which, through the medium of relays, operate heavy quick-break switches operating under oil according to the impulse of thermocouples terminating within the furnace chamber. The power supply for the secondary of the transformers is carried directly to the furnace heating elements through these quick-break switches.

THE belt conveyor forms an endless chain, the discharge end of which is carried within the furnace chamber and the charging end extended a short distance out of the furnace chamber in order to facilitate the loading of work. Thus it is seen that the whole length of the conveyor, with the exception of the short distance at the loading end of the equipment, is at all times under heat within the furnace chamber. This is done in order to conserve the heat absorbed by the conveyor itself, which would otherwise be lost to the atmosphere if the return flight of the chain belt were run outside and under the furnace chamber.

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DIRECTLY under the discharge-end drum of the conveyor within the furnace chamber there is placed a chute extending vertically downward into the loading end of a mechanical quench tank. Thus the work is carried from the charging end of the furnace equipment through the furnace chamber on the continuously moving chain belt, and allowed to drop from the chain belt directly into the quenching medium.

✦ ✦ ✦

AN endless belt running within the quenching medium receives the pieces directly from the furnace, carries them a short distance under the level of the quenching fluid and then carries them upward to a point at which the pieces are easily unloaded into boxes as they fall from the conveying belt.

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THE design of this equipment is such that one man, continuously loading bolts at the charging end of the furnace, can easily supply what supervision is necessary for the entire hardening and quenching process.

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THE appearance of the furnace equipment and the quench tank are well illustrated in the accompanying photograph. Some idea of the size of the equipment may be gleaned from the overall dimensions, which for the furnace are approximately 22′6″ long by 6′0″ wide by 10′3″ high overall. The quench tank with its mechanism is shown with its loading and extending under the discharge end of the furnace.

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THE quench tank itself including sealed chute and discharge conveyor is approximately 18′3″ long by 4′5″ wide.

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PERHAPS the most interesting phase of the operation of this equipment is the means by which the various bolts are kept from oxidizing while in process. It is a well known fact that steel at the high temperatures is detrimentally affected by atmospheric oxygen in the air in that an iron oxide scale, similar in chemical composition to rust, is formed upon the piece.

✦ ✦ ✦

TO overcome this, the furnace chamber is made as gas-tight as possible and then purged of air by means of a continuously flowing stream of inert gas. This gas, which is usually referred to as a "special atmosphere", is composed of the products of combustion formed by the burning of ordinary natural gas or its synthetic equal, manufactured gas. The prior combining of atmospheric oxygen with

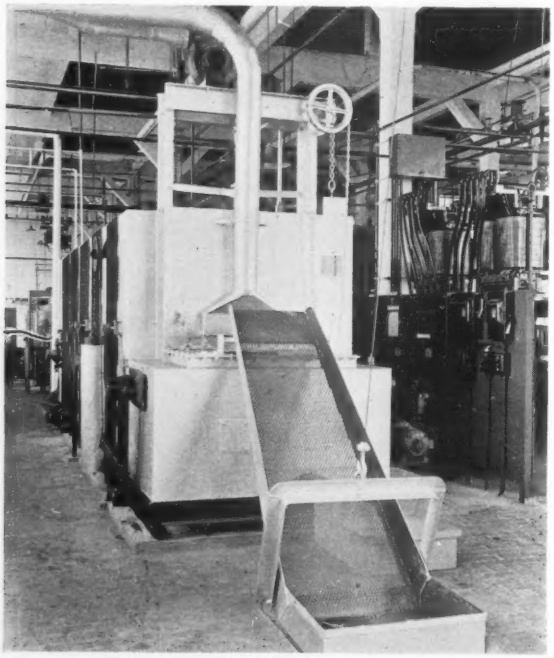


Fig. 1. View of charging end of a 140 Kw., continuous chain belt conveyor, special atmosphere furnace for scale free hardening 1000 lbs. of bolts etc. per hour. The feed chute is loaded in the position shown and then elevated so that the bolts gradually feed onto the traveling belt. ✦ ✦ ✦ ✦

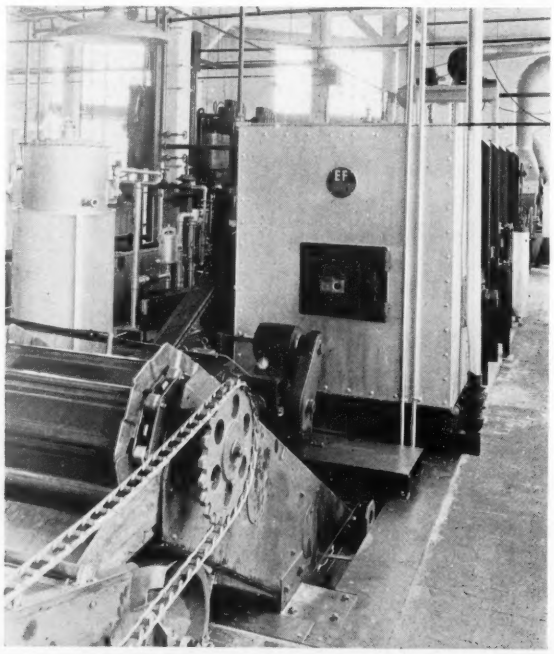
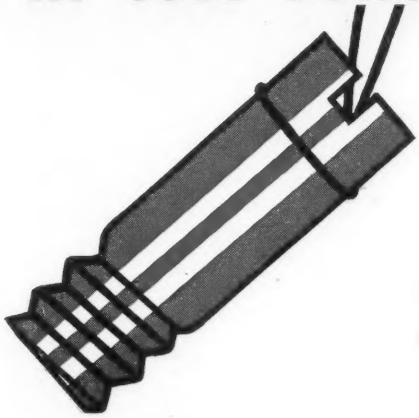


Fig. 2. Discharge end of a continuous, chain belt conveyor, special atmosphere furnace. This view shows the quench tank which is located below the floor level into which the bolts are dropped directly from the traveling belt through a sealed chute. The material is then automatically conveyed from the quench by the flight conveyor shown in the foreground. The Elfurno generator for producing the special protective atmosphere is shown at left of furnace. ✦

72%

SAVING IN COLD FORGING THIS PRODUCT



COST PER 100

Screw Machined . . . 61¢

Cold Forged . . . . . 17¢

Here is a typical example of how a well known manufacturer is making tremendous savings in the production of a small part. How do you know that you can't save just as much by cold forging some of your products? Don't let your competitor get ahead of you in changing to this high-speed method. Manville cold forging machines often double or triple production speed. They are scrapless . . . there's no stock waste. The strength of the finished blank is often increased due to improved grain structure.

Labor costs are brought down, too. And Manville machines use wire instead of bar stock—a 14% saving in stock cost alone. Learn from your Manville representative what Manville cold forging can do for you. Or, send samples of your small parts to us. The same precision which goes into the manufacture of our high-speed headers is also found in Manville Bolt Head Trimmers, Screw Thread Rollers and Screw Slotters. Write for information.

E. J. MANVILLE MACHINE CO., Waterbury, Conn.

1209 Swetland Bldg., Cleveland, Ohio

MANVILLE

COLD FORGING MACHINES

the carbon and hydrogen elements of the raw gas removes the free oxygen which might otherwise attach the work as it rises to its high temperature within the furnace chamber. The special protective atmosphere used in the equipment is produced in an Elfurno gas generator which is furnished as part of the complete installation.

✦ ✦ ✦

AS the bolts are continuously within this special atmosphere until the moment when they drop from the conveyor belt into the quenching medium, the work is brought from the quench in a clean, scale-free condition and similar in appearance to the unhardened stock being charged into the furnace.

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THE connected load of this equipment, insofar as the heating capacity is concerned, is approximately 140 kilowatt hours per hour. The production of the furnace which is approximately 1000 gross pounds per hour, varies according to the size and weight of the bolts run, the ability of the bolt material to absorb heat and the density of loading upon the conveyor belt.

✦ ✦ ✦

THE equipment described is one of two similar units in the above plant and was designed and manufactured by The Electric Furnace Company of Salem, Ohio, whose pioneering in the development of intricate furnace equipment and the applications of special atmosphere have given many outstanding developments to the industrial world.

New Developments In Roofing Nails

By James S. Maze,
W. H. Maze Co., Peru, Ill.

Desirable qualities and means of providing them in nails for wood shingles, asphalt roofing, and metal roofing described.

A ROOF cannot last longer or give better service than the nails which hold the roofing material in place. The bill for excessive roof depreciation on farms, due to improper nails, now amounts to about 20 million dollars annually.

✦ ✦ ✦

THERE is very little that any of us can do to correct or replace improper nails now in use, for the renailing of roofs is not practical except in a limited way. However, we can do something for the roofs which are to be put on in the future. I should like in this paper to tell you about some of the troubles which improper nails cause, and then, if I may, to suggest the proper types of nails to advocate in your specifications, as a means of correcting these troubles in the future.

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ANY approach to this question of assisting in the selection of proper shingle and roofing nails must be made with the understanding that it is purely an educational problem. Buyers have been in the custom of blaming the shingles or roofing when troubles occurred. Our problem is to show them that in nine out of ten cases, the trouble is due to improper nails, and that by using proper nails, although they may cost slightly more, the life of roofs can be greatly increased at a saving of money.

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LET us approach the question, therefore, by first illustrating the savings which can be effected by the use of proper nails. Thousands of examples on record might be cited, but the cases of two roofs in central Iowa are perhaps as good as any.

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THESE roofs were constructed with cedar shingles of exactly the same grade. The only difference was that roof A was laid with ordinary galvanized shingle nails at a total cost of $7.00 per square, whereas roof B was laid with proper nails, as recommended by the shingle manufacturers, at a total cost of $7.16 per square.

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ROOF A, with improper nails, had to be replaced in 10 years, due to the fact that the nails had rusted out. Roof B, with the proper nails, was not replaced for 20 years and then only because of alterations in the structure.

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ROOF A, in its 10-year life, had cost its owner 70 cents per year per square. Roof B, in its 20-year life, had cost its owner only 35 cents per year per square, a clear saving of 35 cents per year per square, due to the use of proper nails.

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THE problem of nails for cedar shingles has been a subject of study and concern to the shingle industry for 30 years. It is purely a matter of education, for proper rust-proof nails are available.

✦ ✦ ✦

PROPER nails for red cedar shingles are clearly defined by the shingle industry as follows:

"Be certain that the nail that is chosen is actually hot zinc dipped. So-called 'galvanized' nails, bright and shiny,

Presented before the Farm Structures Division at the annual meeting of the American Society of Agricultural Engineers at Urbana, Illinois, June 24, 1937.

have a coating of zinc so thin that it is useless. The real zinc-dipped nail is not bright; it has a rather rough surface and is dull gray in color. A nail of this kind is really rust proof. If other 'rust-proofed nails' are offered, whether they be cadmium plated, brass plated or cement coated, do not accept them. Exhaustive tests, both in the field and in the laboratory, have definitely proven the enormous superiority of hot-dipped, zinc-coated nails."

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TO those who may have occasion to prepare specifications for a red cedar shingle roof, let me give this word of precaution: Do not content yourself by specifying just "zinc-coated" nails. Zinc-coated nails are made in various qualities. The quality specified by the shingle industry is known as the "hot-dipped, zinc-coated" nail. This means a nail which has acquired its zinc coating by being dipped in pure molten zinc. Use the entire descriptive term "Hot-dipped zinc-coated", and it is well enough also, as an added precaution, to state frankly that this quality should properly cost the user around 2 cents per pound more than ordinary galvanized zinc-coated nails.

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IT is sometimes said that asphalt roofing protects nails from rust and consequently that no special precaution need be taken to secure high grade rust-proof nails for this type of roofing. Regarding the necessity for rust-proof nails with asphalt roofing, it is perhaps sufficient to say that most roofing manufacturers recommend hot-dipped, zinc-coated nails and are in a position to furnish them as a service to dealers who have no other source of supply.

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A COMMON trouble experienced with nails on asphalt roofs is that nails back out or pop out, thus permitting the seams to loosen and leak. Just what causes this is not known. Some say it is the sun; others, the frost; but whatever the cause, it has long been a source of trouble and expense to users of asphalt roofings.

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TODAY there is a nail which overcomes this difficulty. It is known as the spiral nail and has just recently been introduced. A number of the leading roofing manufacturers are packing this spiral nail which is hot-dipped, zinc-coated, in their rolls of roofing. It is a nail with a spiral shank which twists in when driven and holds like a screw. When buying roll roofing, the buyer should insist that the nails contained therein be spirals. If the roofing is to be laid over an old roof the nails furnished will not be long enough. In this case, the user would do well to wait until his dealer can obtain spiral nails in the right length from the roofing manufacturer.

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IN the discussion of nails for cedar shingles and asphalt roofing I have been able to recommend the qualities and types of nails which are universally approved as best by roofing experts, but in the case of nails for metal roofings I cannot do that for at the present time no single style or type of nail enjoys a similar approval due to the fact that a new idea has recently been injected into this field of nails.

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HERETOFORE, practically all specifications for applying metal roofing have stressed the importance of using a lead head nail, the object of which was to seal the nail hole in the roofing.

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RECENTLY, our company advanced the observation that the loosening of nails on a metal roof and resulting opening of the seams is a far greater source of leaks and trouble than any possible leaks through the nail holes. Studies were made showing that the area at the seams exposed to leakage on the average roof are about 200 times the area of the nail holes. In other words, driving rain directed at open seams has 200 times more opportunity of getting through than through the nail holes assuming that the nail holes were open. In practice, of course, the nail holes are filled by the nail.

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THERE are various ways to keep nails from drawing out. One way is to use a long nail and clinch it. However, most people feel that nails should be made in the beginning so that they won't draw out. That is what some of us on the manufacturing end are now trying to do.

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THERE has been developed what is called a calk-screw nail. This nail doesn't carry a lead head. It is fabricated complete from a single piece of steel. When driven, it twists in like a screw. The unique feature of this nail is its cup head which mushrooms over the corrugation and locks the screw from twisting out backwards, an essential feature on any nail employing a screw shank.

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A NUMBER of the lead head nail manufacturers have adopted the idea of a screw also, but with what success I am not prepared to say, for it would seem that lead would be too soft to lock the screw from twisting out backwards.

✦ ✦ ✦

FOR our own lead head nails we have developed and adopted what we call an "anchor" shank which does not rotate when driven and consequently is adaptable to a lead head nail.

✦ ✦ ✦

THE point to bear in mind is that the most essential thing on metal roofs is a nail which holds securely. In my opinion it is more essential that a nail hold securely than that it carry any elaborate and expensive device for sealing the nail hole. Certainly the sealing of the hole has its place, but the main object of the nail is to hold the roofing in place. If it doesn't do this, it is of little value regardless of all other features.

✦ ✦ ✦

Torrington Mfg. Co., Reports Full Quota of Sales on New Spring Machinery For First Six Months Of 1938

THE new line of Spring Making Machines which The Torrington Manufacturing Company, of Torrington, Connecticut, annonuced late in August of last year, has been enthusiastically received by the Trade. The Company reports that sales quota for the first six months has already been achieved. As a result, manufacturing facilities are being expanded for increased production.

Handling "Stalling Loads" Electrically

By F. W. Jessop,
President,
The Ohio Electric Mfg. Co., Cleveland, Ohio

A method for controlling intermittent and irregular loading operations by means of an electrically controlled device.

"STALLING loads" — that is, loads in which the service required is to operate mechanism up to a certain point and then to exert full mechanical pressure to hold it there—are sometimes a difficult problem. The ordinary type of motor is inadmissible because, unlike a steam engine, a hydraulic ram or a compressed air device, it cannot "pull up and stand" under its load. In this the motor resembles an internal combustion engine; it can exert power only while it is running. The reason is that the revolution of the armature or rotor generates a "back-voltage" which opposes the supply current and permits only enough current to flow to make up for the load. If completely stalled, therefore, it generates no back-voltage and the current rises to an excessive amount which will quickly destroy the motor windings unless the fuse blows promptly. There are, however, two chief methods by which "stalling loads" may be handled electrically, and we will consider their comparative advantages with those of each other and of mechanical means of accomplishing the same purpose.

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Steam-Driven Rams

THESE fulfill the required conditions excellently, as to operation. They are, however, subject to certain limitations from a practical standpoint. One of these is the high initial cost of the ram itself and its accessories—which is usually considerably higher than that of an electrically-operated equivalent. Moreover the operating cost is almost always high when the device is not used continuously because of the loss of power through condensation during non-use intervals. The steam pressure must be constantly maintained ready for use; whereas an electrical device uses no power when the current is shut off. The installation cost of piping is another feature which must be considered when steam power is compared with electric. From a maintenance standpoint, the renewal of packings, and the risk of condensed water freezing in the piping or ram must also be taken into account. Nevertheless, in plants where extra steam power is already available, rams of this type are extensively used.

✦ ✦ ✦

Hydraulic and Air-Driven Rams

MUCH the same advantages and objections apply to air and hydraulic rams; for even in the former it is not unusual to find considerable condensed water in the piping—as anyone who has started to clean a motor with compressed air without first "blowing off" the line has found to his cost. However, although an accumulator or an air-receiver may be used to store pressure, (and thus avoid the need for the pump or compresser to run continuously,) the initial, operating and maintenance costs tend to be somewhat higher than for electrical devices of equal stroke and power.

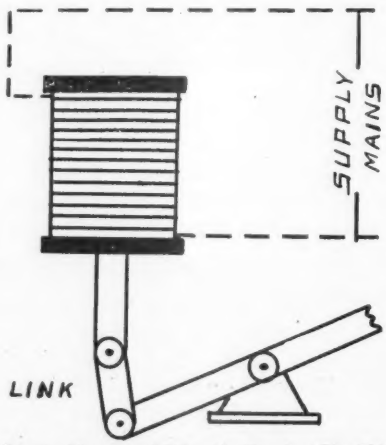

Fig. 1. Diagram of Solenoid. (Courtesy The Ohio Electric Mfg. Co., Cleveland, Ohio.

✦ ✦ ✦

Solenoids

THE solenoid is an electrically-operated device consisting of a movable iron core, (which must be laminated if for use on alternating current) and a hollow coil into which the core is sucked by the magnetic effect of the current in the coil. The solenoid is reliable and positive both in movement and in carrying the "stalling load"; but it is subject to some decided limitations on account of the basic laws of magnetism—viz., the pull varies inversely as the square of the distance between the magnetic centers of the coil and the core. The pull, therefore, varies greatly at different points of the stroke. At its beginning, the pull is comparatively weak. It rises rapidly to a maximum as the core nears the coil's center, at which point it becomes so great that the motion is arrested. To take a practical case, a certain type of high-class solenoid has the following approximate pulls at various distances of travel.

12-inch travel, 60 lbs. pull.
8-inch travel, 100 lbs. pull.
3½-inch travel, 150 lbs. pull.
1-inch travel, 215 lbs. pull.

✦ ✦ ✦

THE acceleration of the core is exceedingly rapid, and the device therefore exhibits a tendency to "slam" unless a dashpot or other

"slowing-up" device is provided. The wear is also apt to require careful attention on account of the wide pull-variation produced by very small maladjustments of the link system which transmits the force to the driven mechanism. For moderate travels up to a few inches, however, the solenoid is widely used. Above that amount the size, weight and cost of a solenoid increase so rapidly that they become almost prohibitive. The solenoid from which the figures just mentioned were taken was 16″ high, 13″ square, and weighed around 400 lbs. Another point to be noted is that a solenoid, especially if on alternating current, is apt to be rather noisy in operation.

✦ ✦ ✦

WHERE longer travels are involved the solenoid is not conveniently adaptable, particularly where the pull or thrust must be practically constant over the greater part of the stroke, ending up with the exertion of full pressure at the "stalling" end. There is also difficulty where the force must be reversed in direction, as for example in the opening and closing of elevator safety gates. A solenoid is inherently irreversible in action, since reversing the current has no effect on the direction of the pull. Thus about the only practical ways to make a solenoid reverse are either to have two coils, each capable of giving the full required pull and set to pull the core in opposite directions alternately; or to compel the core to pull against a spring in one direction and allow the spring to return it in the other. This latter method means of course that in order to have a 100 lb. pull in both dirctions the spring must exert 100 lbs. pressure and the solenoid must produce 200 lbs. It must therefore in either case be much larger than the regular 100 lb. type for one-way operation. Hence, as a rule, such long travel or reversing movements are best handled by a "torque motor" either driving direct or through a speed reducer as may be most desirable to fit the particular case.

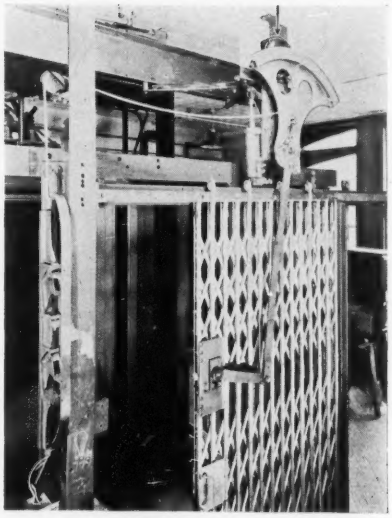

Fig. 2. Torque Motor Operated Automatic Safety Gate Closing Mechanism on an Elevator. (Courtesy The Otis Elevator Co., New York City.) ✦

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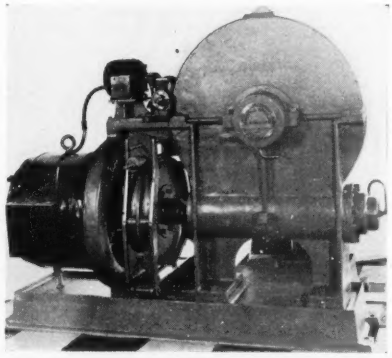

Fig. 3. Brake-Drum Control Mechanism operated by Torque Motor instead of Solenoid. (Courtesy Kimball Bros., Council Bluffs, Iowa.) ✦

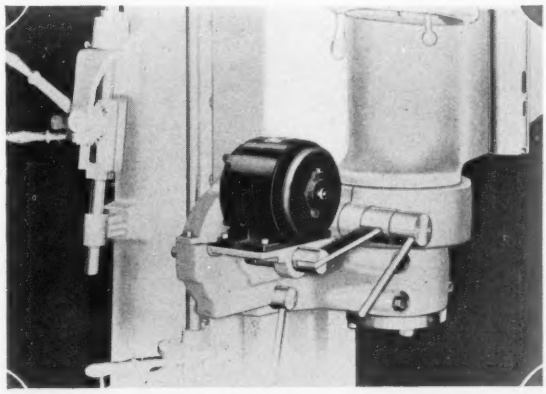

Fig. 4. Radial Drill Arm Clamping Device operated by Torque Motor. (Courtesy The Ohio Electric Mfg. Co., Cleveland, Ohio.)

Torque Motors

A TORQUE motor is a special type of motor, standardized in various sizes and so built that it behaves like an ordinary motor while moving the mechanism it drives; but which, when it is stalled at the end of the stroke, exerts enough back-voltage or opposing effect to the supply voltage to hold the current down to full load and thus exerts full load torque. This torque is translated by suitable means into the required lineal travel and final stalled pressure. How long it can remain thus stalled depends on the motor's "stalling rating". Some ratings may be stalled for only five or ten minutes during each hour, while others will withstand this treatment for many hours at a time without overheating or injury. By the use of the torque motor there are no practical limitations as to the length of travel. Since the motor can be readily reversed it need only exert full load torque instead of twice that amount as in the spring-controlled reversing solenoid. Its smaller size for the long travel will also often effect a substantial saving in installation and first cost, and its maintenance is as low as that of an ordinary motor. In action, it is perhaps slightly less rapid than the "slam-bang" operation of a solenoid; but the difference is small and the reduced wear and maintenance, and its quiet functioning, make it in many cases more desirable. This is especially true if it is located in a spot difficult of access for inspection and adjustment.

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AMONG other suggested applications of torque motors in wire and wire products plants may be mentioned the remote control of steam, gas and fire-protection lines; opening and closing of brakes on the brake-drums of cranes and hoists; and various auxiliary equipment such as the clamping attachment for locking the radial arm of a large drill-press shown in the illustra-

(*Please turn to Page 90*)

Wire Association Questions and Answers

Question 4225

"We are interested in the various processes of tinning plain high carbon steel, ranging in analysis of .65 carbon, .85 manganese and .25 silicon.

One of the processes in mind was drawing the tinned steel from a rye-meal liquor solution and in this process together with any other which you suggest we are interested in the following detailed information:

Where and in what form is the tin or tin compound purchased?

If the pure tin is purchased is it first flaked by melting and pouring into cold or hot water in order to make in a finely divided state for better solubility?

How is the original tinning bath solution prepared, the temperature, what acid concentration is used and how long should the steel be immersed in the tin bath?

After the steel has been sufficiently tinned is it dried or limed and baked before drawing, or if a rye mash mixture is used for wet drawing is the tinned steel immediately placed in this rye liquor?

Where can the best rye-meal be purchased, how is the solution prepared and is a fermented liquor used?

What acid mixture is generally used in pickling the steel before tinning and can yokes containing several coils of wire be cleaned and tinned uniformly?

Is it a general practice to cold draw wire more than one pass after the tinning operation?"

✦ ✦ ✦

Answer No. 1

"THE answers below are based on the assumption that a tin coating is desired either as a lubricant or for appearance of the finished wire. If it is hoped to duplicate what is obtained by hot dip tinning, they are off on the wrong foot.

1. Pig tin (pure).
2. Yes.
3. May be **prepared** either hot or cold. Some old wire drawers say they do better by boiling, others prefer to make up solution cold. It is always **used** cold. Acid concentration should be approximately 10%. Length of time of immersion will depend on surface of the wire, how heavy a coating is desired, etc. Length of immersion time not critical.
4. Not limed or baked. Should be allowed to remain in water for at least 24 hours to permit hydrogen to escape, otherwise may run into "acid brittleness". Coating is put on just before drawing and then wire rinsed and placed in rye liquor.
5. A fermented liquor usually used.
6. May be either the usual sulphuric or hydrochloric acid pickling solutions. Wire can be pickled or yokes if not too closely packed together. Same applies to coating the wire.

A small amount of copper sulphate will be found to help a great deal in making up the solution. However, the more $CuSO_4$ that is added the redder will be the color of the coating.

7. Yes."

✦ ✦ ✦

Answer No. 2

"WE regret not being able to give you anything very definite, as we have had very little experience with High Carbon Steel. However, from the type of questions which are asked, we surmise that what this member wants is not what we know as "tinning", but rather a "white liquor finish."

For this process the tin may be purchased in pig form melted and dripped into cold water, producing tin flakes.

There are so many different ways of making the tinning bath solution, that the question is hard to answer. Generally speaking, into half a tub of water about 2 lbs. of Copper Sulphate and one good handful of flake tin are added, and about ¼ of a pint of sulphuric acid. About the only way to get the correct proportions is by experimenting with the above mentioned materials until the desired color is obtained.

After the coil has been coated, it is not limed and baked before drawing, but is placed at once into a rye meal solution for drawing. Any good Feed Store is a source of supply for rye meal.

About 8-10% hot sulphuric acid solution is used for pickling the steel before "tinning", and several coils on a yoke can be pickled at once, but generally speaking, only one coil at a time is dipped in the tinning or liquor finish solution.

As to the number of passes wire so coated can be cold drawn, this depends on the kind and temper of wire to be drawn. Regular low carbon wire can be drawn several passes after one coating.

✦ ✦ ✦

Query on above Question No. 4225

"THANKS for your letter attaching replies to some of our inquiries regarding tinning of wire.

There is one question that is not quite clear and that is we would like to know if the tin is dissolved in concentrated sulphuric acid, or just how is the tin plating solution prepared?"

The Wire Association is for the specific purpose of improving production methods. It was organized as a clearing house of ideas on technical problems and research work in all phases of practical wire drawing and wire working.

The inquiries discussed were received from and answered by members of the Wire Association. These inquiries are sent to the Secretary of the Association who acts as a central clearing point, and neither the names of the firms or individuals sending in the inquiry, or of the men or firms replying are divulged without permission.

Answer No. 1 to Query on 4225

"MOST of our men add sufficient acid to the quantity of water needed and then throw in the $CuSO_4$ and flake tin and allow it to stand for about 24 hours before using. This can be speeded up by boiling."

✦ ✦ ✦

Answer No. 2 to Query on 4225

"IN reply to your letter we would suggest as one method that the (Tinning) White Liquor Finish solution can be dissolved and mixed, is with live steam as follows:

One or two lbs. copper sulphate and one large handful tin flakes be placed in a pail full of rye meal liquor, and then stirred thoroughly by inserting the end of a live steam hose in the solution. When this has been well mixed, it is poured into half a tub of water, and about ¼ of a pint of sulphuric acid is added. The whole mixture again stirred.

We also find that this solution will give better results a day or two after it has been mixed."

✦ ✦ ✦

Question 4226

"As a Member of your Association, I take liberty of approaching you with a problem which is occupying my mind at present, and wonder whether you are in a position to assist me.

We manufacture Spring Steel Wire. As raw material, we purchase Wire Rods from 5 m.m. up to 7 m.m. chiefly in Soft Thomas quality. We water harden these Thomas Rods ourselves in an Electric Furnace about 14 yards long, consisting of four different Zones, in which the heat can be automatically controlled. At the Exit, we water quench these Rods in single strands, as they leave the furnace and not in the Coil.

We have kept the temperature in the neighborhood of 950° C, but we find lately, that a lot of our Wire breaks too easily, and shows signs of segregation. We are just investigating whether this segregation or apparent segregation, is due to actual segregation in the Thomas Rods, or else whether the temperature which we are using results in the formation of Austenite, resulting of quenching in Troostite or Martensite.

Can you investigate whether the temperature is, in your technical experts' opinion, correct or wether same should be kept lower, say down to 700° C. Also at what definite temperature your experts advise us to quench?

Perhaps you can also indicate at what distance the water quenching should be from the actual furnace.

We have also made tests with a temperature of about 800° C, but find that the resiliency which we obtain is not such as we would like it."

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Answer No. 1

"WE regret to advise that our personal contact with this subject is rather limited. That is to say that our experience with this type of steel

Wire Association Questions and Answers

is not extensive. However, theoretical considerations of heat treatment lead us to believe that the temperature of 950° C is not high enough. This temperature is just about the critical temperature of this type of steel, and from our experience in the continuous treating of wire, the temperature should be at least 100° higher than the critical for proper treatment. This means that a temperature of 1050° C or more should be used.

We doubt very much if any traces of segregation would be due to this heat treatment. That is, the treatment should be uniform throughout the section in these sizes.

From our experience, we believe the quench should be as near the exit of the furnace as it is practicable to have it."

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Answer No. 2

"WE regret that we cannot answer this question directly since we do not make heat treated spring wire.

Water quenching from 930° C is quite drastic. The breakage may be due to excessive grain coarsening inherent with certain heats of steel. We have encountered similar experiences with water quenched bars. We do not believe breakage was caused by segregation.

The exact temperature for quenching depends largely on the analysis of the steel, particularly carbon and manganese. For complete transformation the quenching must be performed from temperatures above the upper critical for the particular steel at hand. Resiliency would be lowered by quenching from too low a temperature."

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Answer No. 3

"ALTHOUGH we have no practical experience in the water quenching of low carbon Basic Bessemer rods, we have been interested in the matter from a technical point of view. We believe it is customary for such rods, when intended for ultimate production of upholstery spring wire to be quenched after leaving the last pass in the rod rolling mill. Presumably this quench would be from a temperature of over 900° C. In quenching from such high temperatures it would be very important that the quench should be strictly uniform in all parts of the rod to avoid variations in temper throughout the cross section of the rod and in various parts of the rod length, otherwise I would expect trouble in drawing. As the rod leaves the last pass in the rolling mill it would be practically free from scale which would help in obtaining a uniform quench.

When the rods have not been quenched at the mill and are reheated later we would expect the rod emerging from the reheating furnace to carry more or less scale which might interfere with uniformity of temper when quenching from temperatures as high as 950° C. It may be also that the facilities for quenching are not as adequate as have been installed at the rod rolling mills. From both the above considerations it would seem more desirable to quench from a temperature of about 700° C and from what I have read on the subject the age hardening which takes place on quenching from 700° produces a considerably higher ultimate tensile strength than when the quench is from 950° C. Quenching from the lower temperature (700° C.) would, it seems to me, make the chance of irregularity of temper much less than when quenching from 950° C.

We note that when quenched from 800° C. the ultimate tensile strength was lower than desired and this agrees with published information on the subject."

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Answer No. 4

"TELL your inquirer that the quenching of low carbon steel to stiffen it for springs is entirely unknown in the United States. The best thing ever published on the subject is an article by Hans Wiesecke that appeared in Stahl und Eisen, Germany, about six years ago."

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Answer No. 5

"THE above question was submitted by a correspondent who desires to know whether or not his heat treatment of spring steel wire of soft Thomas quality is satisfactory. This correspondent's practice is so much different from any practiced in the United States that I would like to have the privilege of corresponding directly with him.

There is very little spring steel wire made in the United States of soft Thomas quality which I assume to be under .25% carbon. The small amount of spring wire in these ranges that is made, is drawn direct from the rod just as it leaves the rod mill without any initial or intermediate heat treatment whatsoever.

The correspondent's water quenching practice is so much different than any that I am acquainted with that I would like the privilege of direct correspondence.

As matter of information, whenever steel in these low carbon ranges is badly segregated, we obtain hard spots in the bundle where the water on the reels and reel pipes quenches that particular section. This condition may be comparable with that which the correspondent has in his water quenching heat treatment but I would like to find out why it is necessary to heat treat in such a manner and what kind of resiliency he obtains by such treatment. It may be that the correspondent is way ahead of us on spring steel wire manufacture and instead of his asking us questions, we would like to ask him questions and to have some of the wire so made."

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Question No. 4227

"We are having considerable difficulty in making a wire with a suitable finish, for spot or gang welding, in sizes from No. 8 to No. 19 gages, low carbon stock, Basic steel, .06 to .12 Carbon and .25 to .35 Mn. Usually made soft, as in brite market wire, and usually drawn one hole, one gage after annealing.

I realize that most organizations class this as one of the trade secrets of the industry, but I am wondering if some of the fellow members of the Wire Association would be kind enough to help me out.

We have tried several methods of cleaning and several grades of lime, greases, soaps, and oils, have been used, and we still have not accomplished the desired results. We realize that cleaning, inhibitors, lime, baking, drawing speeds, and lubrications all play a very important part in making bright wire for this purpose, but we do not seem to get the correct amount of each, to accomplish the purpose.

We will appreciate any effort you may put forth in obtaining the above information."

Answer No. 1

"WIRE suitable for spot or gang welding should be drawn wet with copper coating."

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Answer No. 2

"WE do a lot of welding and have little if any trouble. I would be glad to correspond direct with questioner. If I could get some of his samples of wire could tell where his trouble is. Many times the steel is blamed for faults in welder itself."

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Answer No. 3

"THERE is really no trick to producing wire for this purpose, if the Rods are properly cleaned and the liming is held to a minimum. Sulcoating, of course, is very detrimental as it carries more lime into the surface of the wire. The primary purpose of drawing in this particular connection is to produce a surface as free from lime and lubricant as possible, and if this idea is kept in mind in the drawing of the wire, your members should have no trouble whatever in producing satisfactory material for spot or gang welding.

We note that your member mentions that the wire is usually made soft as in Bright Market Wire, and usually drawn one hole after annealing. We might mention that most of the wire which is used in this particular type of work is direct drawn wire rather than processed wire. Naturally, in processing and giving one draft, there will be more lubricant in the surface of the wire than where the wire is direct drawn."

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Answer No. 4

"(1) Research should be made on the type of steel made, guarding carefully that the Copper content at no time exceeds .25.

(2) The Sulphur content should be carefully checked to see that it does not exceed .040.

(3) Assuming some of the fabrication might be galvanized and re-phosphoriz-

(Please Turn to Page 100)

Exports and Imports of Wire

Exports of Iron and Steel Wire Products in Nov. 1937 and Nov. 1936 (In Gross Tons)

	NOV. 1937	OCT. 1937	NOV. 1936
Wire rods	6,445	7,182	3,493
Strip steel	7,105	7,885	6,006
Plain, black or galvanized iron or steel wire	3,232	4,568	3,635
Barbed wire and woven wire fencing	1,807	2,994	2,484
Woven wire screen cloth	66	111	104
Wire rope	358	486	.....
Insulated iron or steel wire and cable—see analysis below			
Other wire and manufactures	475	680	363
Wire nails	685	704	337
Tacks	46	41	17
Other nails, including staples	187	279	138
Bolts, machine screws, nuts, rivets and washers	779	937	598
Total, these 11 classifications	21,185	25,867	17,175

Imports of Iron and Steel Wire Into the United States (In Gross Tons)

Concrete reinforcement bars	43	14	101
Hollow bar and drill steel	188	295	38
Wire rods	1,405	1,282	1,222
Barbed wire	1,446	2,367	480
Round iron and steel wire	250	308	437
Telephone and telegraph wire	.....	1	1
Flat wire and strip steel	669	288	214
Wire rope and strand	188	309	171
Other wire	97	99	49
Hoops and bands	1,582	1,310	2,365
Nails, tacks and staples	552	1,010	531
Bolts, nuts and rivets	16	69	68
Total, these 12 classifications	6,436	7,352	5,677

Exports of Insulated Wire and Cable, November, 1937

	Foreign		To U. S. Possessions	
	Pounds	Dollars	Pounds	Dollars
Insulated iron or steel wire and cable	37,656	$ 6,108	1,406	$ 180
Rubber-covered wire	625,586	165,118	89,672	20,924
Copper weatherproof wire	229,795	41,696	76,143	14,796
Copper telephone cable	10,234	4,341	357	116
Other insulated copper wire	257,090	73,807	336,210	69,010
Nickel-chrome electric resistance wire	50,291	58,544	.....	.....
Total, these 6 classifications	1,210,652	$349,614	503,788	$105,026

November Tin Plate Shipments At Monthly Peak

FEATURING the November export trade was the record level of tin plate shipments. The 52,795-ton total for that month represented the most tin plate ever exported from the United States in any period of similar duration. The leading markets (in a widespread trade) were:

	Tons
Brazil	6,227
Japan	5,246
Argentina	4,876
Soviet Union	4,228
Kwantung	4,140
Hong Kong	3,529

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Heavy Trade in Steel Ingots and Plate Continues

SHIPMENTS of steel ingots were next in importance (from a volume standpoint) with 36,231 tons going mostly to the United Kingdom (24,015), Japan (4,265), British India (3,894), and Mexico (2,236). Ranking next was plate (boiler, fabricated, and 'other') with a 35,908-ton total going chiefly to Sweden (8,695), Kwantung (8,483), Japan (3,151), and Hong Kong (2,140). Rail shipments registered an increase to 26,475 tons and were taken mostly by Kwantung (13,606), Brazil (7,749), and Mexico (2,310). Pig iron shipments (26,225 tons) ranked fifth and were shipped principally to the United Kingdom (7,763), Japan (8,806), Italy (1,969), Germany (1,340), and Czechoslovakia (1,060).

United Kingdom Takes Highest Tonnage in November

EXPORTS to the United Kingdom at 50,192 tons represented the highest tonnage shipped to any individual market during the month reviewed, the outstanding items in this trade being ingots (24,015), pig iron (9,763), steel bars (5,685), black steel sheets (4,070), wire rods (3,183), and strip steel (1,629). Next in importance were shipments to Kwantung (32,643 tons), the bulk consisting of rails (13,606), plate (8,483), tin plate (4,140), plain shapes (2,361), and rail joints (2,048). Then came shipments to Japan (27,390 tons) which took mostly tin plate (5,246), ingots (4,265), pig iron (8,806), plate (3,151), steel bars (1,939), and wire rods (1,711). Canada ranked next with 24,910 tons of chiefly black steel sheets (4,650), strip steel (3,329), shapes (2,962), plate (2,033), steel bars (1,816), tin plate (1,677), and skelp (1,593). The Soviet Union followed with 19,857 tons of principally car wheels and axles (6,545), tin plate (4,288), black steel sheets (4,114), and seamless boiler tubes (2,544). Shipments to Brazil — the next market of importance — totaled 19,412 tons, the items predominating being rails (7,749), tin plate (6,227), rail joints (1,110), and black steel sheets (1,081).

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Pig Iron Continues Leading Import Products

DESPITE a sharp decline, pig iron (from a tonnage standpoint) continued to be the outstanding product imported. The total of 6,661 tons compared with 11,870 tons in October and 10,615 tons in November, 1936, came mostly from British India (5,286 tons), and the Netherlands (1,001 tons). Structural shapes were next in importance with a 3,968-ton total (4,097 tons in October; 5,817 tons in November 1936), and Belgium supplied 3,643 tons. Following was steel pipe, 2,795 tons (1,781 tons; 2,969 tons), coming principally from Germany (2,264 tons), and Sweden (380 tons). Fourth in importance were solid and hollow steel bars 1,811 tons (1,928 tons;

3,705 tons) received chiefly from Belgium (1,098 tons), and Sweden (439 tons). Hoops and bands were next with 1,582 tons (1,310 tons; 2,375 tons), Belgium supplying the bulk (1,404 tons). Barbed wire followed in a trade totaling 1,446 tons (2,367 tons; 480 tons) with Germany (1,169 tons) the leading country of supply.

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Belgium Leading Source in November

IMPORTS from Belgium during November (6,860 tons) represented the highest amount received from any import source and were mainly shapes (4,643), hoops and bands (1,404), and solid and hollow bars (1,098). British India accounted for 5,286 tons—all being pig iron. Third in importance were receipts from Germany (4,150 tons), including steel pipe (2,264), and barbed wire (1,169). Then came Sweden with a 3,545-ton total of (mostly) wire rods (1,405), flat wire and steel strips (591), solid and hollow bars (439), and steel pipe (380). Next were receipts from Canada (1,632 tons), the principal products being spiegeleisen (438), cast-iron pipe and fittings (383), pig iron (374), and rails and track material (320).

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THE total for CARD CLOTHING was 28,216 square feet valued at $41,944 in comparison with 26,143 square feet valued at $41,042 in the preceding month, the outstanding supplying countries being the United Kingdom (24,752 square feet and $35,434), and Belgium (3,446 square feet valued at $6,225).

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THE WIRE HEDDLE trade amounted to 223,000 pieces against 421,000 pieces and was covered by Germany (120,000 pieces), and Switzerland (103,000 pieces).

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IMPORTS of WIRE FENCING AND NETTING, galvanized before weaving, amounted to 5,000 square feet—a sharp decline from the 511,875 square feet total received in October. Japan accounted for all of the November trade. Of the galvanized after weaving grade, the total was 1,248,950 square feet against 3,429,725 square feet with Belgium (659,825), the Netherlands (335,625), and Germany (262,500) accounting for the entire trade.

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WIRE CLOTH AND SCREEN was imported to a total of 51,106 square feet against 103,212 square feet and came mostly from Germany (30,433), and Canada (17,215).

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FOURDRINIER AND OTHER PAPER-MAKING WIRE receipts at 37,427 square feet compared with 28,530 square feet in October, the chief supplying countries being Austria (11,659), Sweden (7,878), Germany (7,006), Belgium (5,457), and France (5,427).

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EXPORTS of iron and steel wood screws during November, 1937 totaled 52,859 gross valued at $7,146. Of this total Philippine Islands took 38,410 gross valued at $3,936; Nicaragua 3,269 gross valued at $556; Costa Rica, 2,805 gross valued at $506; Venezuela 1,120 gross valued at $359; Mexico 1,095 gross valued at $355; Dominican Republica 1,010 gross valued at $202.

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EXPORTS of brass wood screws during the same month totaled 9,916 gross valued at $7,340. Of this total Venezuela took 3,089 gross valued at $3,185; Panama 2,282 gross valued at $1,275; Philippine Islands, 1,005 gross valued at $202; Cuba 873 gross valued at $232; Netherland Indies 750 gross valued at $653.

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IMPORTS of wood screws during the same month totaled 47,575 gross valued at $2,240. Of this total Japan supplied 43,112 gross valued at $1,833; Italy 4,300 gross valued at $344 and Sweden 163 gross valued at $63.

New "Midget" Electric Soldering Pliers

IN answer to the increasing demand for a smaller low capacity soldering unit, that would heat electrically, sweat joints without unsweating adjacent connections, and eliminate open flame hazards, the Ideal Commutator Dresser Co. 1936 Park Avenue, Sycamore, Illinois, has introduced the new No. 2 "Midget" Type Thermo-Grip Pliers.

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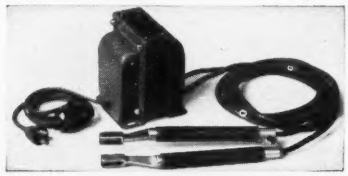
THIS tool has been designed especially for soldering small objects and for work in restricted spaces and for ease of operation. A few typical applications are: For soldering small lugs and terminals up to 150 amp., in close quarters on switchboards, motors, generators—for various small radio and appliance soldering—for sweating



joints on small copper tubing and fittings up to ⅜" diameter.

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THE small power requirement (300 watts) permits the use of the unit on any standard lighting circuit without danger of overloading the circuit or burning out fuses.

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THE Pliers are made of cast bronze (long, slender, small jaws), so that they will fit into restricted spaces. The jaws are hinged at the back and have a spring, which holds them normally in the open position. Further information can be obtained by writing the manufacturer.

MAKE YOUR PLANS NOW TO COME TO THE WIRE ASSOCIATION MEETING

'Round the World With the Wire Industry

Erection of Wire Factory in Norway

A GOVERNMENT guarantee of some 100,000 crowns has been authorized by the **Norwegian** Cabinet for use in the construction of a poultry wire factory being erected near Bergen. This factory will be the first of its kind in Norway. Imports of poultry wire range from 70,000 to 80,000 metric tons, and come chiefly from the United Kingdom, and Germany.

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The Anglia Company, Ploesti, Roumania

THE Anglia Company of Ploesti, Roumania, recently opened its plant for a visit to a large group of leading industrialists, bankers and Government officials of Roumania. They were received by **Percy R. Clark**, managing director, who, attended by the engineering staff, showed them through the plant.

MR. Clark is responsible for the establishing of the wire rope industry in Roumania and personally supervised the construction and equipment of these steel wire rope mills with the result that the plants are said to be thoroughly modern in their equipment in every way.

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THE Anglia Company has recently installed machines for a new type of wire rope which they claim is somewhat revolutionary in its design and is particularly applicable to the oil, mining, and lumbering industries of Roumania.

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IN connection with the development of this mill under the supervision of Mr. Clark, the company has built a model village of attractive cottages and apartment houses with baths, gardens and all details necessary to the comfort of the workmen.

THE company also offers a series of evening lectures under the direction of Professor Ganciu to its workmen including classes in German and English.

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German Notes

WOOD screw prices on the German domestic market have been reduced 5%, and prices for bolts and nuts, 2½%. This is the second price reduction during 1937. Nearly all wire products have been reduced 2 to 4%.

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MORE than 4000 tons of wire products, originally destined for Hangkou, Shanghai and Canton during July, August and September, but unloaded at Singapore or other Far Eastern ports, have been disposed of by the European manufacturers. Approximately 2000 tons were sold to other Far Eastern markets, and the remaining 2000 tons were immediately ordered for shipment to Shanghai when

A NEW DEVELOPMENT FOR GALVANIZERS G.B. 412

A Blanket Covering for Molten Metal Baths Zinc, Lead, Tin and Their Alloys.

PREVENTS OXIDE FORMATION
PREVENTS LOSS OF HEAT BY RADIATION
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EASILY APPLIED

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FORTY YEARS OF SUCCESSFUL SERVICE

the fighting left that immediate territory. German exporters have not suffered heavy losses, except where the original Chinese wires have disappeared and the goods had to be sold at reduced prices to other merchants.

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German Rod Production

GERMAN wire rod production during October established a new all time record amounting to 106,820 tons, which is about 13,000 tons more than the same time last year. Wire rods are one of the few products which can be supplied in quantities to nearly full requirements. The shipment dates for export are about eight weeks and for domestic consumption 10 weeks; the price remaining at £6.15 to 7. (gold). On the export market Thomas steel quality is almost exclusively demanded; very few orders being booked for open hearth steel quality.

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German Exports

THE export demand for wire nails has slowed down during the past month, but German industry is still overstocked with orders and the shipment dates are 12 to 14 weeks. The demand for barbed wire, fencing wire and wire netting is also continuing. Special wires, particularly for the manufacture of springs, needles, chains, musical instruments, mattresses, etc., are in good demand, and prices are comparatively very high. The IWECO has informed the leading exporters that current prices will not be changed during the next months. The German manufacturers and exporters are interested in the outlook for an agreement with the American industry. The agreements which exist concerning mutual market interests in some Latin American markets have not been expanded to other markets, and according to information received, it is improbable that it will be the case in the near future. American and European wire manufacturers' prices are more or less the same.

GERMAN wire and wire products exports in August were 25,814 tons, in September, 26,918 tons, in October 21,417 tons, and are estimated at 23,000 tons for November. Import figures for wire products are about 10% higher than last year.

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German Wire Mesh Manufacturers Agreement

THE anticipated agreement between the German wire mesh makers was concluded in December with all manufacturers represented and uniform export conditions have been established with the leading export merchants. Export quotations have been slightly reduced; 2′ x 50′ x 16 mesh, green or yellow, soft quality has been quoted at 6/4 shillings; 18 mesh (same quality) at 7/3 shillings and 20 mesh (same quality) at 7/8 shillings. Prices for hard quality have been approximately 20% higher.

GLADER WIRE NAIL MACHINERY

The Glader Nail Machine of today is the result of forty years experience in the building of wire nail machines.

Glader machines are made in ten different sizes, to cover most efficiently, any size of nails.

The production on these machines ranges from 160 nails per minute, made from 3/8" wire 12" long, to 700 nails per minute made from 16 gauge wire 1-1/8" long.

Write for our catalogue and make your own comparison of our guaranteed production figures with what your present equipment is producing.

For further information address,

WM. GLADER MACHINE WORKS

210 N. RACINE AVENUE

CHICAGO, ILLINOIS.

A Review of Recent Wire Patents

No. 2,099,270, APPARATUS FOR COATING WIRE, Patented November 16, 1937 by Owen A. McNamee, Worcester, Mass.

For coating wire with a heat-resistant material such as asbestos, the wire passes through an axial opening in a rotary head which carries a spool of the fibrous insulating material, the head also being provided with carding means for applying the material to the wire and means for assisting in the removal of the material from the carding means to the wire.

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No. 2,099,339, WIRE CONTAINER, Patented November 16, 1937 by Albert N. Joley, Springfield, Mass., assignor to The Diamond Match Company, Wilmington, Del.; a corporation of Delaware.

The container is formed with an annular recess for holding a ring of coiled wire, the wire being drawn over the inner wall of the annular recess and out of the container through an axial nipple. When the wire is fed to a stitching machine, no extraneous straightening devices are required.

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No. 2,099,407, ELECTRIC CABLE, Patented November 16, 1937 by Raymond Charles Mildner, London, England, assignor to International Standard Electric Corporation, New York, N. Y.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

Pressure is maintained on the oil-impregnated insulation of this high voltage cable by a resilient distortable member of oval cross section associated with the core and with its major axis at right angles to the major axis of the oval cable sheath in order to prevent the formation of gaseous spaces in the dielectric.

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No. 2,099,411, MACHINE FOR MAKING AND ATTACHING WIRE BASKET HANDLES OR THE LIKE, Patented November 16, 1937 by Albert H. Schmidtke, St. Joseph, Mich., assignor to St. Joseph Iron Works, St. Joseph, Mich., a corporation of Michigan.

Wire is fed to cutting and forming mechanism which produce a handle of bail shape, the extremities of which are bent to provide attaching portions which are punched through the basket rim and are clenched by being bent upwardly and over the top of the rim. the clenching facilities accommodating variations in the thickness of the material through which the ends of the handle are inserted.

No. 2,099,415, PROTECTIVE JACKET FOR CONDUCTORS OR CABLES, Patented November 16, 1937 by Hans V. Wodtke, Plainfield, N. J., assignor to Anaconda Wire & Cable Company, New York, N. Y., a corporation of Delaware.

Encircling the conductor wire is a body of rubber which is applied in an unvulcanized state and provided with a tightly woven jacket of longitudinal warp strands and helical filler strands. After the assemblage is vulcanized, the jacket constricts the body of rubber, which is maintained in a state of compression, whereby to increase its resistance to absorption of moisture or deteriorating substances such as oil.

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No. 2,099,474, COMPENSATING SPRING, Patented November 16, 1937 by Frederick P. Flagg, Waltham, Mass., assignor to Waltham Watch Company, Waltham, Mass., a corporation of Mass.

Neutralization of the effects of temperature changes on spring-controlled systems, such as watch escapements, is accomplished by the use of a spring so constituted that its strength varies according to the temperature changes. The spring is formed of an alloy containing nickel, chromium, manganese silicon, titanium and iron.

✦ ✦ ✦

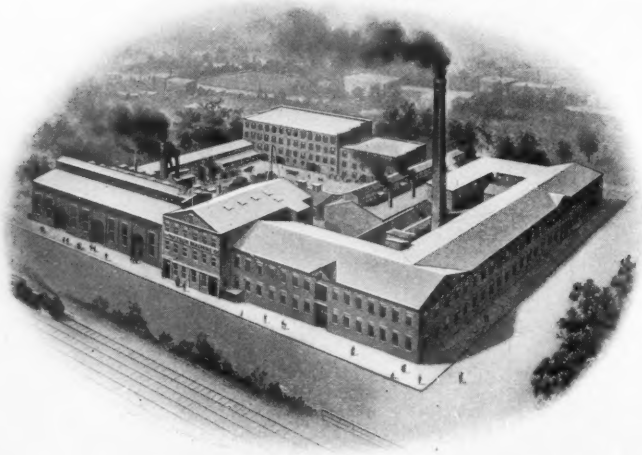
No. 2,099,532, WIRE-HANDLING APPARATUS, Patented November 16,

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ENGINEERS



MACHINISTS

MANUFACTURERS OF

ELECTRICAL WIRE & CABLE, WIRE ROPE, CORDAGE & GENERAL MACHINERY

YOUR INQUIRIES ARE INVITED

1937 by Robert C. Pierce, Niles, Mich., assignor to National Standard Company, Niles, Mich., a corporation of Michigan.

Wire, destined for use in magazine stitchers having irregular feeds, is drawn from the flier on which it is wound, and, prior to passing through a straightening device, is passed over a tensioning device which automatically acts on the swift to regulate a brake so that the tension on the wire is uniform.

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No. 2,099,586, REINFORCED FABRIC AND METHOD OF MAKING SAME, Patented November 16, 1937 by Harold E. Williams, Carthage, Mo.

For use in connection with the padding of mattresses, upholstered furniture, and spring seats, fabric strips are provided which are reenforced by interwoven transverse wires, each having its ends bent toward and around an adjacent transverse wire.

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No. 2,099,876, STRAND HANDLING APPARATUS, Patented November 23, 1937 by Leo. L. Weaver, Cranford, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

Concentrically mounted to revolve about a support on which cops of covering strand are carried is a set of duplex fliers through the arms of which passes a torsionally rigid core on which is impressed, at the serving point, a rotation having a rate which depends on the number of fliers used, and whereby the cover strand is spirally wound upon the core.

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No. 2,100,294, METHOD AND MACHINE FOR PRODUCING BRAZED SEAMS in WIRE CLOTH, Patented November 23, 1937 by Nelson W. Webb, Belleville, N. J., assignor to Eastwood-Neally Corporation, Belleville, N. J., a corporation of N. J.

Wire cloth is laid on a long table with its edges, which are to be joined, in abutment, the brazing being accomplished by a portable machine slidable in any direction on the table so as to follow irregularities in the edges, the machine being provided with a straight edge which guides the cloth edges, a brazing torch, and a low-power microscope for the operator's convenience in observing the brazing operation.

✦ ✦ ✦

No. 2,100,393, BEDSPRING, Patented November 30, 1937 by Lawrence H. Hamilton, Niles, Mich., assignor to National Standard Company, Niles, Mich., a corporation of Michigan.

In conjunction with the conventional vertically disposed coils of a bed spring, resilient woven, braided, or looped wire strips are employed to substantially fill the spaces between the rows of coils, at the top ends thereof, so as to provide a bed spring having an upper supporting surface which will yieldingly support a mattress with no substantial area thereof unsupported, and without interfering with individual action of the coil springs.

✦ ✦ ✦

No. 2,100,475, SPRING SEAT CONSTRUCTION, Patented November 30, 1937, by Hyland C. Flint, Grosse Pointe, Mich., assignor by direct and mesne assignments, to Patent Sales, Inc., a corporation of Michigan.

A synchronization of the vertical and horizontal movements of a spring seat and back rest during use is accomplished by a floating and pivotal suspension of the seat and back in a frame, and this permits the seat and back to be upholstered in one continuous piece without distortion or tearing of the fabric upon movement of the seat.

✦ ✦ ✦

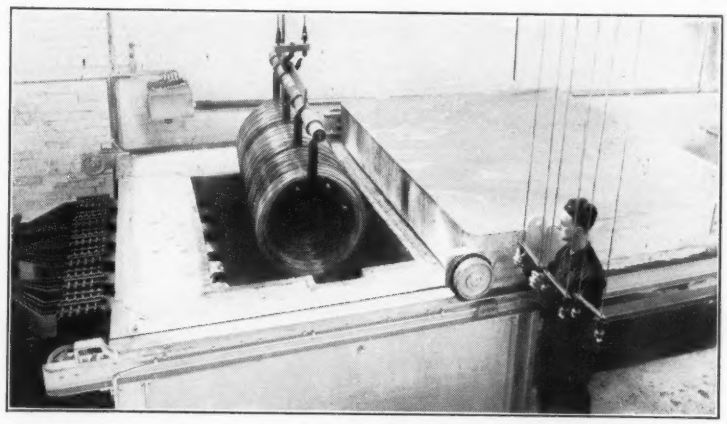
No. 2,100,476, SPRING SEAT CONSTRUCTION, Patented November 30, 1937 by Hyland C. Flint, Detroit, Mich., assignor, by direct and mesne assignments, to Patent Sales, Inc., a corporation of Michigan.

The seat construction relates to a spring unit for chairs, davenports, vehicle seats and furniture wherein synchronization of the movable members effects a floating support for the user, the back rest being provided with primary flexible supporting means of relative stiffness, and secondary flexible supporting means of relative softness for supporting the back in a natural posture.

✦ ✦ ✦

No. 2,100,543, SPRING STRUCTURE, Patented November 30, 1937 by Lawrence H. Hamilton, Niles, Mich., assignor to National Standard Company, Niles, Mich., a corporation of Michigan.

(Please turn to Page 101)



Now that LAVITE FURNACES with pots that are practically indestructible can be supplied for LAVITE Heat Treating Baths, LAVITE means UTMOST ECONOMY - - - and —

Better Physical Properties	Controlled Atmosphere
Better Temperature Control	More Uniform Product
Better Shop Conditions	Reduced Inventory
Less Equipment Investment	Greater Output
Less Floor Space Required	Better Surface
Lower Maintenance Cost	No Dirt or Smoke
Less Heat Cost	No Excess Heat

The Bellis Heat Treating Co.

BRANFORD, CONNECTICUT

originators of

LAVITE furnaces, LAVITE pots and LAVITE heat treating baths for hardening, case hardening, tempering and annealing

Handling "Stalling Loads" Electrically

(*Continued from Page 81*)

tion. For the elevator gate-closing mechanism already mentioned, the comparatively long travel and the need for reversibility render the torque motor decidedly preferable to the solenoid; in fact, a number of freight and passenger elevator makers have adopted these motors as standard equipment. For remote control of steam and fire protection lines, either solenoids or torque motors can be used. As, however, a solenoid-operated valve must be of the needle or plunger type, whereas the more powerful and positive rotary screw valve may be used if a torque motor is employed, the advantage would appear to be in favor of the latter, especially where large valves and high pressures must be controlled. The cost, too,

(*Please turn to Page 92*)

FARREL NI-HARD ROLLS

PRODUCE HIGHER QUALITY FINISH AT LOWER COST

Farrel Ni-Hard Rolls combine a hardness of 80 to 90 scleroscope with high strength and a flawless surface. They are free from pinholes, "orange peel" and other imperfections that mar the rolled sheet. Therefore, they produce sheets with a higher quality finish than can be obtained with chilled or other types of alloy cast rolls.

Farrel Ni-Hard Rolls are more economical. They require less scouring and grinding than any other type of cast roll; they last longer and their cost per ton of output is lower. Increased production is also possible with these rolls, for their greater strength permits heavier passes.

Made of alloy chilled iron containing nickel and chromium, Farrel Ni-Hard Rolls embody the results of 75 years experience in developing correct mixture, melting practice and heat treatment. Every step in their manufacture is under scientific control, including analysis of materials, controlled electric furnace melting, precise heat treatment, physical tests and photomicrographs.

The performance of Farrel Ni-Hard Rolls in many rolling mills has definitely established their superiority. Write for further information.

Farrel-Birmingham Rolling Mill Equipment includes: Rolls — Rolling Mills — Rod Mill Tables and Manipulating Equipment — Universal Mill Spindles —Rod Coilers — Lead Presses for Pipe or Rod — Roll Grinding Machines — Roll Calipers — Gears — Mill Pinions — Pinion Stands — Drives up to 10,000 H.P. — Flexible Couplings.

FARREL-BIRMINGHAM
Company, Inc.
38 Main St., Ansonia, Conn.

Color Coating Enables Easy Identification of Tool Steel Grades in New Bar Spraying Plan

ALTHOUGH tool steel is produced in an unlimited number of varying analyses, there is nothing in the general appearance of the several grades to distinguish one from another. Without marking of some kind, an expert could not tell them apart without making a series of tests. Labels and bar end painting are the common methods of identification. As the bars are used up, however, these markings are destroyed, and the stock clerk who has not at some time made the mistake of sending the wrong steel in to the toolmaker is a rare model of efficiency.

✦ ✦ ✦

THE distinction between the characteristics of various grades of tool steels is so fine that any substitution, through error, is the beginning of a rapidly mounting loss. If, as frequently happens, the mistake is not detected until revealed in the performance of the finished tool, all of the expensive toolmaking and heat treating time will have been wasted. Delays in production while the tools are being remade are a further loss.

✦ ✦ ✦

A LONG experience as suppliers of tool steel convinced A. Milne & Company that a better method of identification than labeling and end marking could be devised, and after considerable experimentation the Color Bar Plan was introduced by them. With this method, colors still are used to identify the various grades of Milne Tool Steel, but the color coating is sprayed over the entire surface of the bars.

✦ ✦ ✦

THE many advantages of the Color Bar Plan to any plant, large or small, that keeps a stock of tool steel, are readily apparent. A bar may be quickly identified, even by inexperienced stock clerks, no matter how much has been cut from it. Also, after cutting, short ends will not be misplaced in the racks with other grades.

WHEN the steel reaches the toolmaker, he can tell definitely, knowing the Color Bar Code, whether the steel delivered to him is correct. No matter how small the piece to be worked, he is no longer dependent on the stock clerk for the proper selection. The heat

treater can confidently follow heat treating instructions, knowing by the color that the steel is the one specified. This positive identification also allays doubts as to machining and procedure in other forming operations.

✦ ✦ ✦

A FURTHER advantage of the Color Bar Plan is that stock clerks can tell at a glance how much steel of various grades is on hand and can keep the proper supply with much less checking. In the smaller shops, different grades can be kept together, when desired, with a saving in storage space, since each steel can be quickly distinguished by the bar color.

✦ ✦ ✦

IN order to educate stockroom clerks, toolmakers, and heat treaters in the Color Bar Code, large wall charts are being distributed by A. Milne & Company which show the actual colors used to identify the several grades. Recommendations for heat treatment of each steel are printed on the chart. The Color Bar Plan is also described in the new A. Milne & Company catalogue and in sales literature, to quickly familiarize tool steel users with its advantages and with the bar colors.

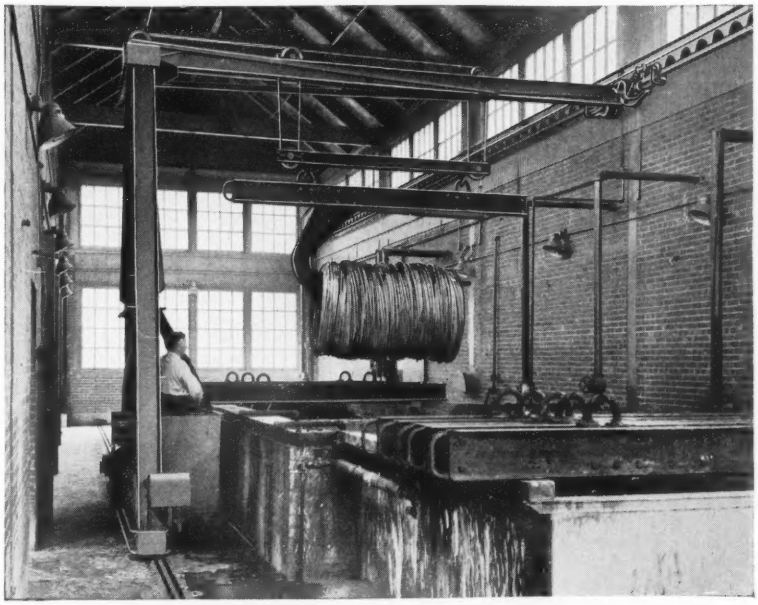
Contour Machining

"THE Contour Machining Handbook", the new title of the revised and enlarged edition of the earlier handbook on contour sawing, adequately describes the wide subjects covered by this new 106 page book. Tables for the correct machining speeds for either sawing or filing 48 materials are given. These materials range from plastics to SAE 1090 and high chrome high carbon steel. Other new subjects covered in this handbook are the elimination of machining strains by correct sawing technique, the wider infinitely variable speed range now possible, the simple butt welding of the precision narrow saws as accomplished for internal cutting and additional illustrations and case records dealing with unusual contour machining jobs. This Handbook is offered free and may be secured by application to the Engineering and Research Department, Continental Machine Specialties, Inc., 1301 Washington Avenue South, Minneapolis, Minnesota.

CLEVELAND TRAMRAIL

MATERIALS HANDLING EQUIPMENT

Serving Various Departments
in the
Wire and Wire Products Industry



• Straight Line cleaning house layout eliminates congestion, speeds up production, reduces floor area required per given tonnage—and lends itself more readily to expansion. These facts are true regardless of your tonnage.

Consult your phone directory under Cleveland Tramrail.

CLEVELAND TRAMRAIL
Division of
THE CLEVELAND CRANE & ENGINEERING CO.
1141 Depot St.
WICKLIFFE, OHIO

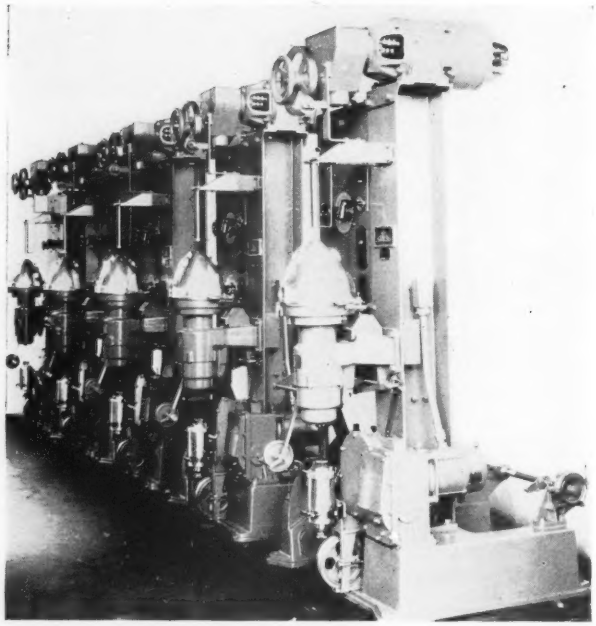
Handling "Stalling Loads" Electrically

(*Continued from Page 90*)

is apt to be lower than with a solenoid. For operating the valves on gas-fired ovens for baking, japanning, etc., or for annealing furnaces, it is evident that the screw valve permits intermediate adjustments which give closer temperature control. Operation of automatic switch sequence control, as in rolling mill and similar production work, offers another possibility for torque motors because their action is smoother and less noisy than solenoids. For crane and hoist brake drum work, this smoother operation permits very close control at times when the load must be "inched" up or down.

The Detroit-Leland Hotel will be headquarters for the 1938 Wire Association Meeting in Detroit.

SYNCRO



SYNCRO INSULATING MACHINES

accurately serve wire with tape and strands at

ONE TURN PER INCH

Paper, cellophane, cellulose acetate, etc., as well as celanese, cotton and silk are efficiently served with a flyer speed variable from 2500 R. P. M. to 5000 R. P. M.

SYNCRO MACHINE COMPANY

NEW YORK CHICAGO NEWARK

Research Accomplishments of United States Steel Corporation During 1937

WITH the close of 1937 United States Steel Corporation ends a decade of intensive research. During this period the widespread research and technical activities of its subsidiary companies functioned for the first time in conjunction with a central laboratory. Ten years ago Dr. John Johnston came down to Kearny, N. J., from Yale University to establish a central laboratory which would deal with major problems affecting all products made by subsidiary companies.

✦ ✦ ✦

RESEARCH and development work in 174 laboratory departments throughout the Corporation come under the direct supervision of Rufus E. Zimmerman, Vice President in charge of Metallurgy and Research. Grouped into 89 organizations in 64 laboratory buildings, these laboratories required an expenditure of some $8,400,000 in 1937. If concentrated in one building, the total floor space in all of these laboratories would measure 50x200 feet and stand 40 stories high.

✦ ✦ ✦

OUT of the work in Dr. Johnston's and subsidiary laboratories has emerged a more complete understanding of what happens to steel throughout the multiple steps in its manufacture. Scientific research into the fundamentals of steel making has made it possible to develop new products which are tougher, more ductile, and less corrodible. Practical results have already been demonstrated in the ability to make far better rails, lighter and stronger vehicles for transportation,—and now a new tempering process gives much greater toughness and strength than was ever believed possible in plain carbon steel.

✦ ✦ ✦

Alpha and Gamma Iron

SOLVING the Dr. Jekyll and Mr. Hyde behavior of iron when under the influence of heat is regarded as an outstanding technical

development to which research scientists of United States Steel Corporation subsidiaries made important practical contributions in 1937.

✦ ✦ ✦

"UNDERSTANDING this 'dual personality' of iron and learning to control it to the point of practical application justifies the prediction that America is entering a new era in the manufacture of steel in which man's most useful metal will be tailor-made for a wide variety of uses," according to Dr. Johnston, Director of Research.

✦ ✦ ✦

AS a result of the investigations, physical metallurgists know that the atomic structure of iron assumes two distinct forms controlling its propensity for dissolving carbon. Known as alpha and gamma iron, these two atomic arrays change from one to the other at a specific temperature as the iron is heated up or cooled down through the same temperature range.

✦ ✦ ✦

BY the proper control of conditions it is now possible to modify at will and with more certain knowledge the internal structure and hence the final properties of the metal within a considerable range, correllating microscopic architecture with properties. This knowledge is expected to lead to a steady advance in the usefulness of steel with direct advantages to the public at large.

✦ ✦ ✦

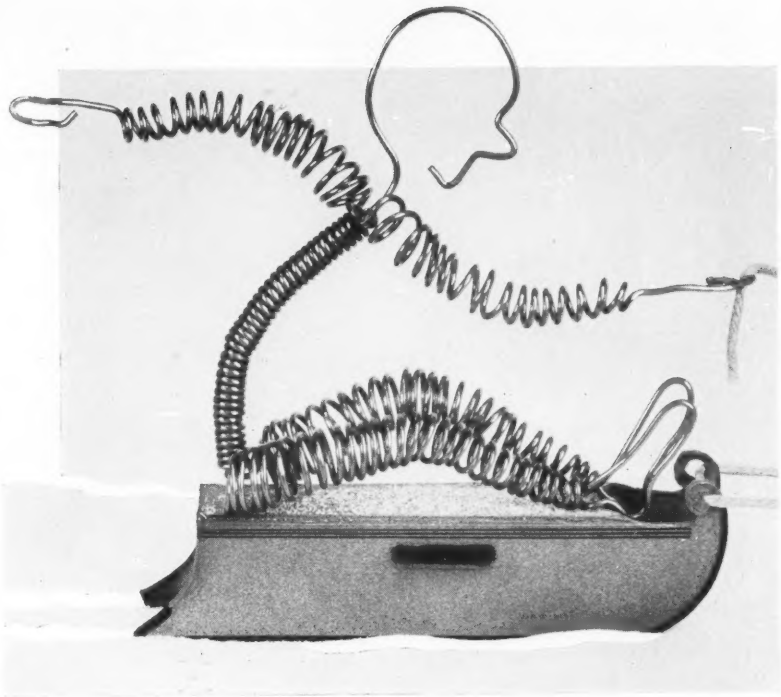
Creep

"CREEP" deformation, or the slow continued stretching which metallic parts undergo when subjected to tension under high temperature has received special study throughout 1937 by metallurgists of United States Steel subsidiaries. They have been able to report valuable contributions to accumulated data on this subject.

✦ ✦ ✦

CREEP in steel products is motion so slow that it must be measured in millionths of an inch per inch per hour. Translated into longer distances, an object moving

(*Please turn to Page 94*)



SMOOTH SLEDDIN'
with the right *Wire*

Production skims along at a faster clip when you "hook on" to the right wire for your requirements. Does your process call for unusual bending, forming or welding qualities? Does it require a special analysis, finish or temper? Whatever you need, Keystone either has it or will make it to your order. And always, you can rely on perfect uniformity. Toss us a line and we'll show what we can do.

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or
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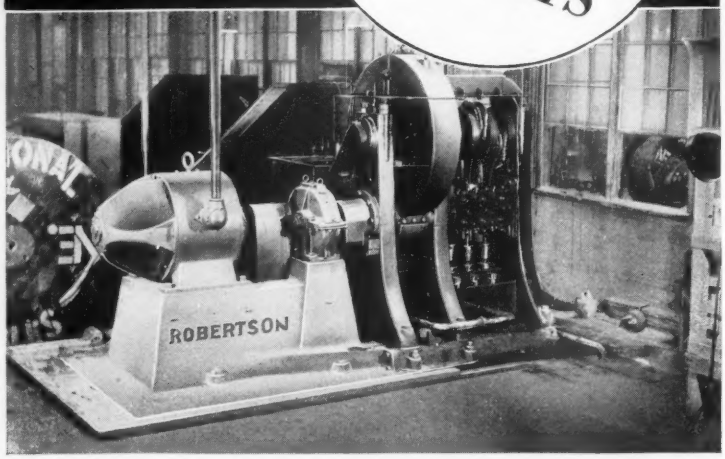
Bright... Tinned
Coppered
Annealed
Galvanized

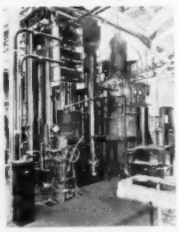
ROBERTSON HYDRAULIC PUMP

at NATIONAL ELECTRIC PRODUCTS



Integral to the fine quality of National products is Robertson Hydraulic Equipment. New installation includes Robertson Hydraulic Pump shown above; a 2100 - ton Robertson Press.

It's a complete installation typical of Robertson preferment throughout the world. Preferment that is a sure sign of outstanding equipment, made worthy of the Leaders by the dependable, economical performance it gives.



Showing Robertson Press and Melting Pot at Triangle Conduit and Cable, another leader using Robertson.

Details? They're yours, without obligation. Just a note on your letterhead brings them all.

John ROBERTSON CO. INC.
Pioneers~Since 1858
125-137 Water Street · Brooklyn, N. Y.

Research Accomplishments of United States Steel Corporation During 1937

(*Continued from Page 93*)

at this rate would take 13,704 years to move a foot, or 72,357,120 years to move a mile.

✦ ✦ ✦

IN their studies of this subject, U. S. Steel metallurgists have concluded that reliable data cannot be obtained unless the specimens are subjected to creep tests for a period of at least 3,000 hours (about 4½ months). Another innovation they have adopted is the use of Least Squares for analyzing the data obtained. They find that this method eliminates the "personal error" involved in graphical analysis.

✦ ✦ ✦

THE electric furnaces used for creep tests in the Kearny laboratory are of special design, embodying several unique features. One of these is the automatic control of temperature throughout the specimen within plus or minus 1°F. Another is the marking of the specimens with indicating lines in such a manner that both marks fall in the range of a single microscope which is portable and can be attached to a pinnion alongside each of twelve furnaces used for these tests. Sensitivity of microscope has been increased to be consistent with other refinements of test.

✦ ✦ ✦

RESULTS of the tests to date indicate that special methods of heat treatment may make it possible to improve the natural resistance of certain steels to creep. The problem is of importance in the manufacture of equipment subjected to stress at high temperatures.

✦ ✦ ✦

STEAM pipe lines and oil cracking stills made of steel, having an unduly high creep rate, may cause persistent operating difficulties or failures in service. Lack of knowledge of creep characteristics in certain steels now restrict pressures at high temperatures in such equipment, thereby placing an economic limit on the sizes to

which oil cracking stills may be constructed. Continued studies of "creep" are being prosecuted in the interest of solving the troublesome problems of those who use steel at relatively high temperatures.

✦ ✦ ✦

Brunorizing

RELAXATION, a recognized aid to human longevity, is now being utilized in various methods of heat treatment in the steel industry, growing out of research studies that have shown the characteristics of ductility, strength, toughness, and internal stress to vary according to the grain size. This relaxation accompanies a method of controlled cooling in which rail steel initially is allowed to cool only to a few hundred degrees below its critical temperature. It is then reheated to above its critical temperature before it is allowed to cool completely, the process refining the grain structure of the metal.

✦ ✦ ✦

ONE practical application of this process is in the Brunorizing treatment for railroad rails. Such relaxation in a rail is conducive to longer life because it delays fatigue which might ultimately result in a transverse fissure. In the "relaxed" rail the internal stresses are minimized so that a vastly smaller proportion of the total rail strength is accounted for by the fruitless "pulling and pushing" within the rail and a high proportion of the strength is available to resist the fatigue of repeated loads under the wheels, which exert veritable blows at high train velocities.

✦ ✦ ✦

BRUNORIZING by controlling the grain size of the steel has facilitated the "end-hardening" of rails. It practically eliminates the wearing down of rails at the ends, known as "batter", caused by the hammering action of the wheels leaving one rail and impacting the next.

✦ ✦ ✦

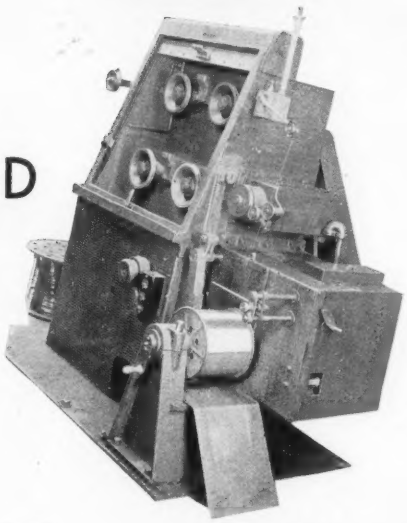
Welded Rails

MENTION of technical developments in connection with

(*Please turn to Page 96*)

ES

HIGH SPEED



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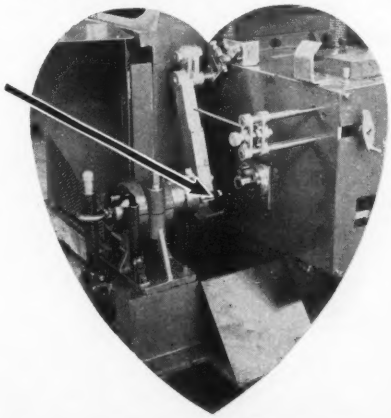
WIRE PRODUCTION

PERFECT control of wire finishing speed is accomplished by maintaining spool R. P. M. relative at all times to package diameter. A momentary contact at predetermined intervals of the non-metallic roller at end of Indexing Arm with wire, causes an incremental speed reduction and retracting of arm to next position of contact. When the desired amount of wire has been spooled, an adjustable cam operates a switch to stop machine at pre-determined spool weight.

INHERENT features of design and control in ELEVATOR SUPPLIES WIRE DRAWING MACHINES assure efficient, economical operation, and a uniformly clean and properly spooled product.



ELEVATOR SUPPLIES COMPANY, Inc.
WIRE MACHINERY DIVISION
EXECUTIVE AND SALES OFFICE
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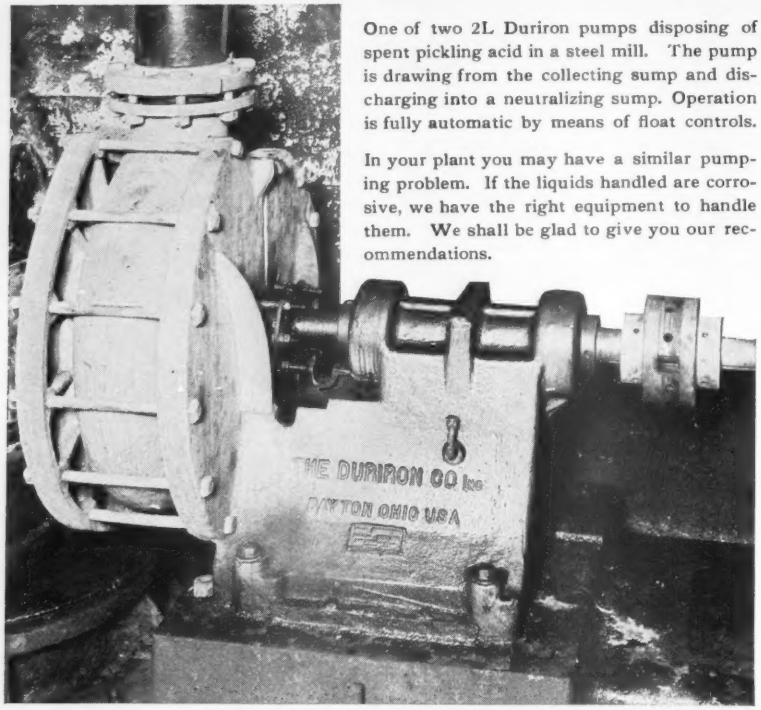
RAHWAY, N. J.
IN CANADA
CANADIAN ELEVATOR EQUIPMENT CO. LTD., TORONTO, ONT.



One of two 2L Duriron pumps disposing of spent pickling acid in a steel mill. The pump is drawing from the collecting sump and discharging into a neutralizing sump. Operation is fully automatic by means of float controls.

In your plant you may have a similar pumping problem. If the liquids handled are corrosive, we have the right equipment to handle them. We shall be glad to give you our recommendations.

THE DURIRON COMPANY, Inc.
445 N. Findlay Street Dayton, Ohio

Hauck Proportioning Oil Burner
(Patent Pending)

FIRST introduced on a trial basis in January, 1937, this burner has performed remarkably in metallurgical, chemical and ceramic plants.

✦ ✦ ✦

IT automatically proportions and maintains correct, straight line air-oil ratio from minimum to maximum capacity, giving accurate temperature control over an unusually wide operating range. It produces controlled furnace atmosphere, giving CO_2 readings between 13 and 15%.

✦ ✦ ✦

BY moving a single lever, air and oil supply is automatically controlled and maintained and primary and secondary air orifices are simultaneously adjusted. This eliminates frequent adjustment of burner and regulation of air and oil valves. Very low and efficient flame turndown can be obtained. Since air is controlled by burner nozzle orifices, maximum atomizing air pressure and constant air velocity are maintained at the point of oil atomization. Thereby reduced air pressure is eliminated at point of oil atomization when burner is turned down.

✦ ✦ ✦

THIS is the only burner ideally suited to automatic control. It maintains maximum combustion efficiency and perfect atomization at all positions of the burner dial. A battery of burners may be operated from one control motor, with each burner being its own individual air-oil mixer, not affecting the other proportioning burners in the group.

✦ ✦ ✦

THE Hauck Proportioning Oil Burner burns any grade of fuel oil. Tests on several hundred burners on various heat processing operations show fuel savings of from 10 to 15% in oil consumption.

Make Your Plans Now to Attend The Wire Association Meeting in October, 1938 at Detroit, Mich.

Research Accomplishments of United States Steel Corporation During 1937

(*Continued from Page 95*)

railroad products recalls the interest welded rails have created during 1937.

✦ ✦ ✦

FOR two years a test mile of welded rails has been under observation near River Valley, Pennsylvania. Measurements made periodically show that although the maximum change of temperature was from 60° to 110°F., or a total of 50°F., the maximum range of movement was only 5/32 of an inch. So far there have been no instances of rupture in the thermit welds. Although the overcoming of contraction and expansion in rails by special fastenings seems surprising in view of the common interpretation of one of the laws of physics, such data as these will throw considerable light upon the performance of relatively long lengths of welded track.

✦ ✦ ✦

Austempering

AUSTEMPERING, a method of heat treating which has been under investigation for a number of years, shows bright possibilities of imparting certain alloy steel properties to ordinary carbon steel.

✦ ✦ ✦

IT is a process in which a steel product is cooled almost instantly from a point above its critical temperature to some lower level and held at substantially constant temperature depending upon the final characteristics desired, in a bath of molten salt or lead for a predetermined time period. This differs radically from the well-known quench and temper method and develops extraordinary ductility even at relative high hardness. The adoption of this treatment for certain products makes possible lower costs and improved physical properties.

✦ ✦ ✦

THE foregoing examples give a glimpse of the research achievements brought to practical culmination during 1937. Further development of these subjects will enlarge the versatily in meeting the modern living demand.

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Germany

Research on Fatigue Properties of Heavy Helical Springs

(*Continued from Page 73*)

graph shown in Figure III is for these points, and its probable equation is:

$$(N+198.17)\ (S-58.17)=13671.84$$

✦ ✦ ✦

THE probable endurance limit indicated —58,170 p.s.i.—is a disappointingly low figure, as compared with the showing of the open hearth basic springs, Series A, and confirms the indications of the physical test results. A supplementary analysis, using the test results of all eleven springs which ran to failure, results in a somewhat higher predicted endurance limit; namely, 65840 p.s.i. But, as explained above, the fatigue values used in the original analysis were selected for the express purpose of obtaining a predicted endurance limit comparable with that of Series A, and the figure so obtained should be considered as the official result.

✦ ✦ ✦

IT seems clear that in future tests the stresses for the fatigue runs must be selected with great care, with relation to the maximum "solid" stresses, in order to obtain consistent results.

✦ ✦ ✦

THE poor performance of this series of springs is entirely inconsistent with the general reputation of electric carbon steel, and arrangements are being made for a repeat series on this grade.

Part III With Data on Fatigue Tests on Silicon Vanadium Steel Springs Will be Published in the March Issue.

Manufacturers of materials, tools and equipment for wire drawing and forming plants are constantly making improvements and additions to their lines. If you do not find the product or service in which you are interested, additional information will be supplied promptly. Simply address:

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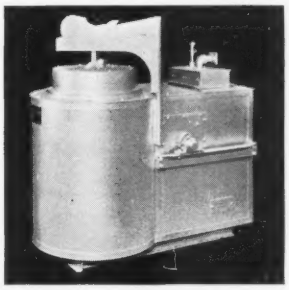
Quickest Deliveries
Safest Guarantees
Best Selections
Lowest Costs



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Revolutionary advance in furnace design which gives new high efficiency in production.

Cyclone action forces heat directly through the densest charge, producing increased speed and uniformity in tempering.

Cyclone construction withstands unusual abuse, reducing production delays and maintenance costs to a minimum.

Electric and Gas Fired Types with Precision Control. Bulletins on request.

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Electrical Developments in Steel Mills During 1937*

NEW construction in steel mills was again centered around strip mills, as in other recent years. Several large hot-strip mills were placed in service or were under construction.

✦ ✦ ✦

THE maximum width of mills was increased to 98 in., the delivery speed was stepped up to 2150 ft. per min. and the total capacity of main drives on a single hot-strip mill reached a value of more than 42,000 hp. The maximum capacity of a single motor for such a mill was increased to 5000 hp.

✦ ✦ ✦

APPRECIABLE power saving, smoother and simpler control, and saving of substation space are features of a radically new method of driving the runout tables and coilers of wide-strip mills. Instead of using squirrel-cage motors and supplying them with adjustable frequency from d-c to a-c motor-generators, the latest three mills employed d-c mill-type motors (one motor per roller or per pair of rollers) furnished with power from one or more adjustable-voltage generators.

✦ ✦ ✦

THE speed of cold rolling of strip has been stepped up in several instances to about 1750 ft. per min. with a 2000-ft. per min. goal within sight. This requires greatly increased power and a still greater precision of control. The electric tensiometers for indicating and controlling strip tension between stands have been finding a wider use.

✦ ✦ ✦

A VERY interesting and novel rod mill, newly built and electrified, is arranged to finish four strands of rods simultaneously, at a speed close to 4000 ft. per min. Nine d-c motors with a very special type of control, are employed for driving the mill.

✦ ✦ ✦

THE use of variable-voltage (Ward Leonard with 3-field generators) control for blooming- and slabbing mill auxiliaries was

further increased. In addition to the first equipment of this type, reported a year ago, additional ones are being supplied for three mills under construction. It has been demonstrated in practice that this type of drive reduces not only electrical maintenance but also maintenance of the mechanical equipment it drives.

✦ ✦ ✦

FACTORY-assembled control and switchgear apparatus has become a standard for steel-mill applications because of a great saving in installation time.

*Abstract from the General Electric Review "Developments in the Electrical Industry During 1937" by Guy Bartlett.

✦ ✦ ✦

New Sound Motion Picture — "Steel, Servant of the Soil"

A NEW sound motion picture on the production and proper erection of modern woven wire fencing has been released by Republic Steel Corporation, Cleveland, Ohio, through its Agricultural Extension Bureau. The picture requires 45 minutes of running time and is entitled "Steel, Servant of the Soil."

✦ ✦ ✦

TRACING progress in fencing and farming methods, the film depicts some of the crude barriers which served as fences in the early pioneer days. Several particularly interesting scenes show examples of early use of wire for farm fencing. In one instance there is reenacted fabrication of woven wire fence in the field, as was done years ago. Farming methods in the days of ox teams are contrasted with modern power farming.

✦ ✦ ✦

THE film reveals a commonly accepted version of the discovery of iron and shows primitive methods of iron making. Crude native furnaces in Africa and remains of early blast furnaces in this country contribute to the historical background.

✦ ✦ ✦

MODERN mining of iron ore . . . its transportation from the mines to the steel plant . . . its conversion into iron in huge blast furnaces . . . refinement into steel in

(*Please turn to Page 100*)

Learn about PARALAN

Paralan will give your finished wire and wire products protection from atmospheric corrosion in the mill and in shipping. Paralan-coated wire can be spot welded or soldered without cleaning. Also, Paralan leaves surfaces in good condition for all types of finishes—enameling, japanning, lacquering, plating, etc.

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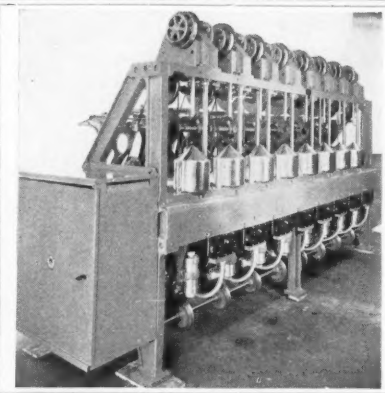

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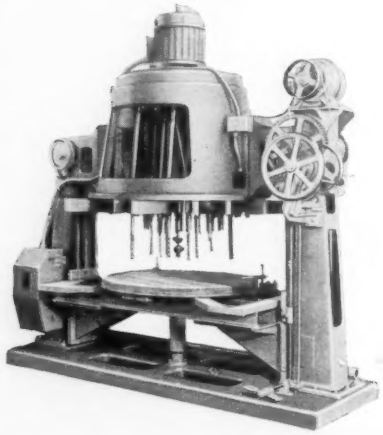
Multiple Boring Machine For Boring Wooden Reel Heads

A MULTIPLE boring machine designed to fill the requirements for a machine to bore all the holes in a wire cable reel in one operation is a recent development.



IN actual practice the machine bores a large number of holes in a large diameter reel head in one-half minute actual boring time. Of course, the time of handling the reel in and out of the machine is dependent on the facilities of the plant using the borer. If they use roller conveyors, the handling time is very small.

✦ ✦ ✦

THE boring area runs from 5″ minimum diameter up to 40″ maximum diameter. The largest diameter of cable the reel will accommodate is 72″ with a maximum clearance between upright columns of 74″. A 5 H. P. motor is required to drive the machine which is 9½ feet high overall; 5′ 2″ wide; 10′ 4″ long and has a shipping weight of 8000 lbs.

New Sound Motion Picture

(*Continued from Page 99*)

roaring open hearth furnaces . . . rolling of the steel and drawing into wire . . . electrogalvanizing by Republic's sensational new process . . . weaving into farm fence . . . scenes showing these and intermediate steps in the making of woven wire fence present a graphic story of one of the world's greatest industries.

✦ ✦ ✦

FOR the first time in a motion picture, proper and approved methods of farm fence erection are demonstrated in detail. Operations such as installation of wood and steel corner posts, preparation of the fence for erection and final stretching of the fence are covered in step-by-step manner.

✦ ✦ ✦

THIS is the third motion picture sponsored by Republic Steel Corporation. Republic presented the first sound motion picture on stainless steel and some time ago collaborated with the U. S. Bureau of Mines in producing a film on alloy steels.

Wire Association Questions and Answers

(*Continued from Page 83*)

ed steel is used, it means that the use of phosphorous presents some detriment for spot welding, but if phosphorus is necessary, regardless it should not exceed .045 for Basic steel.

(4) It is assumed that normal efficient cleaning practice is used, however, in the lime coat for 1 hole work it should be a very light lime dipped into a hot lime tub. The use of too much lime is easily discernible on the finished wire, that should be a guide in lightening the lime to a minimum. It is worth while to mention that thorough baking should be done before drawing. Excess lime is a decided enemy!

(5) As far as drawing speeds are concerned, a Mill with very little difficulty can draw up to 460 F. P. M., especially on the coarser sizes.

(6) As far as lubricant is concerned, all Mills seem to have their own "Pet" —not that it is necessarily a secret, but merely that each one has worked it out by their own resourcefulness. It is suggested that the client be referred to Proctor & Gamble's fine pulverized tallow wire drawing soap, and by using this soap carefully add enough moisture to obtain a clean bright finish."

✦ ✦ ✦

Answer No. 5

"IN reply to your inquiry, we would suggest the member in question try the following procedure.

In the first place, it is important that the wire be thoroughly cleaned after annealing, then a quick dip in a very light lime, and baked dry. We also suggest that the wire be drawn two or more light drafts instead of 1 draft which will not change the tensile strength to any noticeable degree, but aid in giving a better finish.

For this drafting, a very light high grade wire drawing grease is most suitable, because the usual heavy grease will not adhere uniformly enough on the wire for light drafting to prevent it from scratching."

✦ ✦ ✦

Answer No. 6

"IN reply to your inquiry, I regret to advise that I do not have any helpful information to give you as to surface finishes on Low Carbon Welding Wires. Different customers require different surface finishes according to their practices and while to some a small amount of lime or drawing lubricant is not objectionable others want a surface held absolutely free from the same.

In the latter case a good grade of "Brite Wire Drawing Grease" should be used and Cleaning House practices watched carefully."

BULLETINS and information regarding this machine can be obtained by addressing the Editor, WIRE & WIRE PRODUCTS, 17 E. 42nd St., New York, N. Y.

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A Review of Recent Wire Patents

(Continued from Page 89)

Spring structures for seat cushions are formed with the spring coils thereof supported on longitudinally interwoven or braided wire strips and clips are provided for attaching the coils to the braid and having portions encircling and compressing the braid.

✦ ✦ ✦

No. 2,100,544, SPRING STRUCTURE, Patented November 30, 1937 by Lawrence H. Hamilton, Niles, Mich., assignor to National Standard Company, Niles, Mich., a corporation of Michigan.

As a support adapted for inner-spring mattresses, the usual rows of vertical coils of a bedspring are supplemented by lengthwise-yieldable bands between the rows in one direction, and horizontal tension coils between the rows in the other direction, and supporting the bands in parallel relation between the rows.

✦ ✦ ✦

No. 2,100,614, FORM TIE, Patented November 30, 1937 by Tamis C. Schenk, Brooklyn, N. Y., assignor to Richmond Screw Anchor Co., Inc., Brooklyn, N. Y., a corporation of New York.

Two U-shaped wires disposed in parallel relation and a helix of spirally wound rod welded between the four parallel extremities of the wires provide an anchorage which may be embedded in poured concrete, so that a lag screw supported in the helix when the concrete is cast, may be readily withdrawn when the forms are removed.

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CRANES—Cleaning House
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Watson Machine Co., Paterson, N. J.

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Torrington Mfg. Co., The, Torrington, Conn.

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Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
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H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
W. A. Schuyler, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Enameling
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
Royle, John & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY — Measuring Wire & Cable
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works Co., Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Rahway, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
W. A. Schuyler, New York, N. Y.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Strip Covering
Farrel-Birmingham Co., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Farrel-Birmingham Co., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
Amer. Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Rahway, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY— Special — Combination Machine for Drawing, Cutting-to-length. Straightening and Reeling Bars from Coil in One Operation (Shumag Type)—
W. A. Schuyler, New York, N. Y.

MACHINERY—Spooling
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.

WHERE TO BUY, Continued

Fidelity Machine Co., Philadelphia, Pa.
Sleeper & Hartley Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
W. A. Schuyler, New York, N. Y.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing Size of Wire
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Fall, O.

MACHINERY—Tube Mill
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
F. B. Shuster Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Winding
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
Amer. Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Elevator Supplies Co., Inc., Rahway, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
W. A. Schuyler, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
Amer. Insulating Mach'y Co., Phila., Pa.
Elevator Supplies Co., Inc., Rahway, N. J.

MACHINERY—Wrapping Wire
Elevator Supplies Co., Inc., Rahway, N. J.
W. A. Schuyler, New York, N. Y.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Torrington Mfg. Co., Torrington, Conn.

MONORAIL SYSTEMS—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

OVENS—Annealing or Drying
Lindberg Engineering Co., Chicago, Ill.

PAPER—Insulating
E. W. Twitchell, Inc., Phila., Pa.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

PIPING AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

POTS — Annealing, Case Hardening and Tempering
Lindberg Engineering Co., Chicago, Ill.

POTS—Lead Melting
Farrel-Birmingham Co., Ansonia, Conn.
John Robertson Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
Farrel-Birmingham Co., Ansonia, Conn.
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

PYROMETERS—
Leeds & Northrup Co., Philadelphia, Pa.

RECORDERS—
Leeds & Northrup Co., Philadelphia, Pa.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS AND SPOOLS—Shipping and Shop
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Morrison Engineering Co., Cleveland, O.

RODS—Stainless Steel
Rustless Iron & Steel Corp., Baltimore, Md.

RODS—Wire—Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLLS—
Farrel-Birmingham Co., Ansonia, Conn.

RUST PROOF COMPOUND—
American Lanolin Co., Lawrence, Mass.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

SKIN PROTECTOR—
Magnus Chemical Co., Garwood, N. J.

SOAPS—Industrial and Wire Drawing
Magnus Chemical Co., Garwood, N. J.
R. H. Miller Co., Homer, N. Y.

STAINLESS STEEL—
Rustless Iron & Steel Corp., Baltimore, Md.

STRIP—Brass, Zinc and Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Fall, O.

TUBE BENDERS AND FORMERS—
H. J. Ruesch Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Proof
Duriron Co., The, Dayton, O.
Haveg Corp., Newark, Del.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
Amer. Insulating Mach'y Co., Phila., Pa.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Enameled For Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Non Ferrous to Specification For Special Purposes
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Seymour Mfg. Co., Seymour, Conn.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Stainless Steel
Rustless Iron & Steel Corp., Baltimore, Md.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

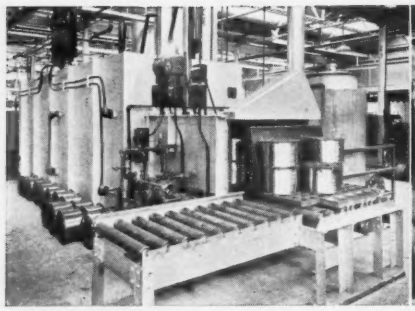
WIRE AND STRIP—Brass, Zinc
Platt Bros. & Co., The, Waterbury, Conn.

MORGAN-CONNOR

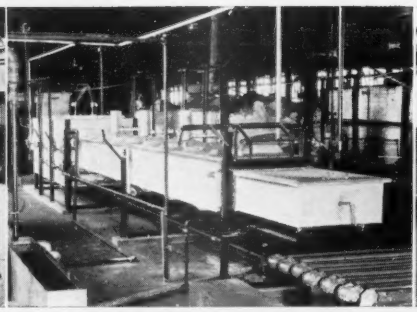
Improved Morgan-Connor Wire Machines produce uniformly good wire, developing higher drawing speeds without the loss of physical properties. Their storage principle of drawing, air cooling, and other exclusive features improve quality, production and profits while holding maintenance costs to a minimum. Morgan Construction Co., Worcester, Mass., U. S. A.

Sole European Representatives — Malmedie & Co., Dusseldorf, Germany

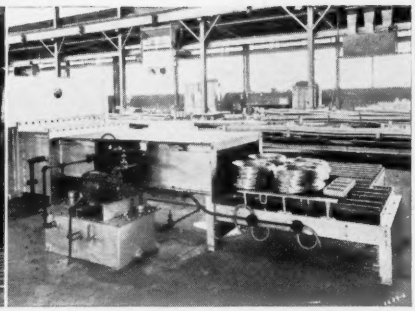
Continuous Wire Drawing Machinery



Bright annealing copper wire on large reels. This continuous furnace handles 36,000 lbs. per day. The wire come out uniformly annealed, bright and dry.



Bright annealing fine copper wire on small spools. This furnace handles 10,000 lbs. per day. All these furnaces can be built in larger or smaller sizes.



Another continuous controlled atmosphere electric furnace for clean annealing large coils of bronze, copper and nickel-silver wire and strip.

Annealing Ferrous and Non-ferrous Wire

The Electric Furnace Company has made a number of outstanding electric and fuel fired furnaces for bright and clean annealing steel, copper, bronze, nickel-silver and brass wire and for normalizing and spheroidizing steel rod. A few furnaces we have built for the wire industry are shown above and below.

We build continuous and batch type equipment for practically every product and for any production — for annealing, normalizing, copper brazing, hardening, drawing, nitriding, heating for forging and for every other industrial heating or heat treating process.

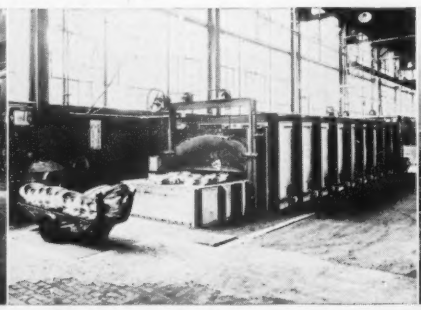
A number of our furnace installations in other plants are shown on back covers of past issues of Wire and Wire Products—watch for our new developments for The Wire Industry.

Write us regarding any of your furnace or heat treating problems.

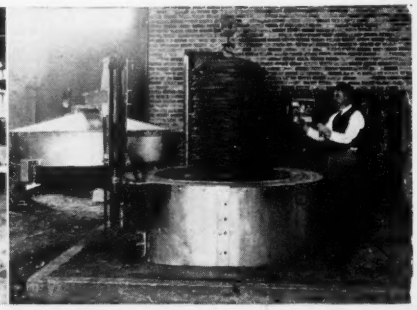
The Electric Furnace Co., Salem, Ohio

Designers and Builders of Electric and Fuel Fired Furnaces and Kilns.

Three fuel-fired pit type furnaces for bright annealing steel wire and normalizing and spheroidizing rod. Three additional furnaces were installed in this plant since this picture was taken.



Fuel-fired furnaces for clean annealing brass and bronze wire in large or small coils—continuously. The material is conveyed through the furnace on heat-resisting alloy chain conveyors.



A pit type electric furnace. One of several installed in prominent steel plants for annealing alloy wire in coils—without scale or decarburization.